U.S. Department of Energy (DOE)
Office of Energy Efficiency and Renewable Energy (EERE)

Bipartisan Infrastructure Law (BIL) Solar and Wind Grid Services and Reliability Demonstration

Funding Opportunity Announcement (FOA) Number: DE-FOA-0002745
FOA Type: Modification 000002
CFDA Number: 81.087

FOA Issue Date:	8/2/2022
Informational Webinar:	8/17/2022 1:00pm ET
Submission Deadline for Concept Papers:	9/15/2022 5:00pm ET
Submission Deadline for Full Applications:	11/17/2022 5:00pm ET
Expected Submission Deadline for Replies to Reviewer Comments:	12/15/2022 5:00pm ET
Expected Date for EERE Selection Notifications:	2/9/2023
Expected Timeframe for Award Negotiations:	2/13/2023 – 6/29/2023

- Applicants must submit a Concept Paper by 5:00pm ET on the due date listed above to be eligible to submit a Full Application.

- To apply to this FOA, applicants must register with and submit application materials through EERE Exchange at https://eere-Exchange.energy.gov, EERE's online application portal.

- Applicants must designate primary and backup points-of-contact in EERE Exchange with whom EERE will communicate to conduct award negotiations. If an application is selected for award negotiations, it is not a commitment to issue an award. It is imperative that the applicant/selectee be responsive during award negotiations and meet negotiation deadlines. Failure to do so may result in cancelation of further award negotiations and rescission of the selection.

NOTE: REGISTRATION/SUBMISSION REQUIREMENTS

Registration Requirements

There are several one-time actions you must complete in order to submit an application in response to this Announcement (e.g., obtain a Universal Entity Identifier (UEI) number, register with EERE eXCHANGE.gov, register with the System for Award Management (SAM), register with Grants.gov, and, if selected for award, be registered in FedConnect). Applicants who are not registered with SAM and Grants.gov, should allow at least 44 days to complete these requirements. It is suggested that the process be started as soon as possible.

Applicants must obtain an UEI from the SAM to uniquely identify the entity. The UEI is available in the SAM entity registration record. NOTE: Subawardees/subrecipients at all tiers must also obtain an UEI from the SAM and provide the UEI to the Prime Recipient before the subaward can be issued.

Applicants must register through the EERE eXCHANGE.
EERE eXCHANGE website: https://eere-exchange.energy.gov/

Applicants must register with the SAM.
SAM website: http://www.sam.gov/ NOTE: Designating an Electronic Business Point of Contact (EBiz POC) and obtaining a special password called an MPIN are important steps in SAM registration. The applicant must maintain an active SAM registration with current information at all times during which it has an active Federal award or an application under consideration.
More information about SAM registration for applicants is found at:
https://www.fsd.gov/gsafsd_sp?id=gsafsd_kb_articles&sys_id=650d493e1bab7c105465eaccac4 bcbcb.

Applicants must register with Grants.gov. Grants.gov website: http://grants.gov/
Applicants must register with Grants.gov in order to receive automatic updates, in the event that Amendments to this FOA are posted. However, please note that applications will not be accepted through Grants.gov. More information about the registration steps for Grants.gov is provided at**:**
https://www.grants.gov/web/grants/applicants/registration.html

Applicants must register with FedConnect. FedConnect website: www.fedconnect.net.
In the event that an application is selected for negotiation of award, Applicants must be registered with FedConnect to receive the award. For more information regarding registration with FedConnect review the FedConnect Ready, Set, Go! Guide at
https://www.fedconnect.net/FedConnect/Marketing/Documents/FedConnect_Ready_Set_Go.pdf.

Submission Requirements

All application submissions are to be made via the EERE eXCHANGE at **https://eere-exchange.energy.gov/**. To gain access to the EERE eXCHANGE system, the applicant must first register and create an account on the main EERE eXCHANGE site. This account will then allow the user to submit an application for open EERE Funding Opportunity Announcements (FOAs) that are currently in EERE Exchange. It is recommended that each organization or business unit, whether acting as a team or a single entity, utilize one account as the appropriate contact information for each submission.

Applicants will receive an automated response when the Application is received; this will serve as a confirmation of EERE receipt. Please do not reply to the automated response. A "User Guide" for the EERE eXCHANGE can be found on the EERE website at https://eere- exchange.energy.gov/Manuals.aspx after logging in to the system.

To receive notices via email regarding an FOA in EERE Exchange, such as amendments to the announcement or the posting of new questions and answers from eXCHANGE you must initiate an application submission to the FOA of interest. Please note that you must finalize and submit your application before the specified due date and time to be considered for award.

Questions

Questions related to the use of the EERE eXCHANGE website or technical issues concerning the application submittal should be submitted to: EERE-ExchangeSupport@hq.doe.gov.

Questions related to the content of the Funding Opportunity Announcement must be submitted to: SI.Grid-FOA.SETO@ee.doe.gov and shall be submitted not later than five (5) business days prior to the application due date and time. Questions submitted after that date may not allow the Government sufficient time to respond.

All questions and answers related to the content of this FOA will be posted at https://eere-exchange.energy.gov/FAQ.aspx. Applicants are encouraged to check the FAQ prior to submitting a question. DOE will try to respond to questions within 5 business days.
Applicants are encouraged to review the posted questions and answers daily. **Please note that you must first select this FOA Number in order to view the questions and answers specific to this FOA**.

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Modifications

All modifications to the FOA are [HIGHLIGHTED] in the body of the FOA. Changes from modification 000001 are highlighted in yellow.

Mod. No.	Date	Description of Modification
000001	08/05/2022	A broken link was fixed in Section I.A.vi - Teaming Partner List. The correct website link for the Teaming Partner List was added as well as specifying the list is available on EERE eXCHANGE.
000002	08/23/2022	Extended the Concept Paper Submission Deadline from 9/1/2022 to 9/15/2022. Updated the FOA timeline on the FOA cover page to accommodate this change.

I. Funding Opportunity Description

A. Background and Context

The U.S Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE) is issuing, on behalf of the Solar Energy Technologies Office (SETO) and Wind Energy Technologies Office (WETO), this Funding Opportunity Announcement (FOA). Projects awarded under this FOA will be funded, in whole or in part, with funds appropriated by the Infrastructure Investment and Jobs Act, Public Law 117-58,[1] also known as the Bipartisan Infrastructure Law (BIL).

The BIL is a once-in-a-generation investment in infrastructure, which will grow a more sustainable, resilient, and equitable economy through enhancing U.S. competitiveness, creating good jobs, ensuring stronger access to economic, environmental, and other benefits for disadvantaged communities. The BIL appropriates more than $62 billion to DOE[2] to deliver a more equitable clean energy future for the American people.

Over the four-year period encompassing fiscal years (FYs) 2022 through 2026, the BIL will invest $40 million for solar energy—and $60 million for wind energy--research, development, demonstration, and commercialization activities[3]. This includes establishing demonstration facilities and projects, conducting analyses and studies, and conducting education and outreach in support of solar and wind technologies.

Under this FOA, EERE expects to make a total of approximately $26 million of federal funding available for new awards. EERE anticipates making approximately 6 to 9 awards under this FOA between two topic areas. EERE may issue one, multiple, or no awards. Individual awards may vary between $2,250,000 and $5,600,000, depending on the topic area.

This FOA and any related activities support BIL sections 41007(b) and 41007(c). The programmatic authorizing statutes are 42 U.S.C. 16238(b)(2) and 42 U.S.C. 16237(b)(2). The sections are focused on carrying out research, development, and deployment of solar and wind technologies through a broad set of activities, such as awarding grants, providing small business vouchers, establishing prize competitions,

[1] Infrastructure Investment and Jobs Act, Public Law 117-58 (November 15, 2021).
[2] U.S. Department of Energy. November 2021. "DOE Fact Sheet: The Bipartisan Infrastructure Deal Will Deliver For American Workers, Families and Usher in the Clean Energy Future." https://www.energy.gov/articles/doe-fact-sheet-bipartisan-infrastructure-deal-will-deliver-american-workers-families-and-0
[3] Infrastructure Investment and Jobs Act, Public Law 117-58, sec. 41007(c)(1) (November 15, 2021).

conducting education and workforce development activities, and funding competitive awards on a merit-review basis, which is the goal of this FOA. In these sections, these activities may be carried out on a broad range of subject areas, such as new materials, advanced manufacturing practices, and system integration. The subject areas from this list pertaining to this FOA are:

- Developing new hardware and software to enable advanced technologies
- Integrating solar and wind energy systems with the electric grid and other energy technologies, such as other generation, demand response, and energy storage.

It is critical that the projects not only contribute to the energy technology goals, but also (1) support the BIL objectives to invest in America's workforce by including specific elements to accelerate job growth and job quality, including the free and fair chance to join a union; and (2) advance DOE's equity, environmental and energy justice priorities, including DOE's commitment to the Justice40 Initiative.[4] The Justice40 Initiative establishes a goal that 40% of the overall benefits of certain federal investments flow to disadvantaged communities.

i. Background and Purpose

This FOA is being issued by EERE on behalf of SETO and WETO to invest in innovative research and development (R&D) that accelerates the large-scale development and deployment of solar and wind technologies to support an equitable transition to a decarbonized electricity system by 2035, and a decarbonized energy sector by 2050. Achieving this goal will support the nationwide effort to meet the threat of climate change and ensure that workers and communities all across America benefit from the transition to a clean energy economy.

With this FOA, SETO and WETO plan to support demonstration projects that integrate variable renewable generation with other large-scale or aggregated distributed energy resource (DER) technologies to provide critical grid-supporting services. These demonstrations, which will last for 6-12 months of the anticipated 36 month award period, at wind, solar, or hybrid power plants (plants comprised of a mix of solar, wind, or other generation or storage technology) at least 10 MW in size, are critical to understanding and addressing the unique challenges related to integrating hundreds of gigawatts of wind and solar generation onto an electricity grid historically designed for large-scale centralized energy generation located far from consumers. This FOA will support

[4] The Justice40 initiative, created by E.O. 14008, establishes a goal that 40% of the overall benefits of certain federal investments flow to disadvantaged communities (DACs). https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf

projects that demonstrate innovative approaches to essential grid services such as voltage and frequency control and power recovery during system-wide outages (among others[5]).

Additionally, this FOA will support the development of new tools and technologies to ensure that when more solar and wind generation are deployed on the grid, the transmission grid's protection system will continue to mitigate grid disturbances and protect against cyber and physical risks.

SETO supports solar energy research, development, demonstration, and technical assistance in five areas—photovoltaics (PV), concentrating solar-thermal power (CSP), systems integration, manufacturing and competitiveness, and soft costs—to improve the affordability, reliability, and domestic benefit of solar technologies on the electric grid. In May 2021, SETO released its Multi-Year Program Plan,[6] which describes its activities and specific goals for 2025. In September 2021, DOE released the Solar Futures Study,[7] which examined solar power's role in decarbonizing the grid by 2035 and 2050. Both of these documents guide SETO's research, development, and demonstration efforts.

WETO plans and executes a diversified portfolio of research, development, and demonstration to reduce the cost of wind energy by advancing technologies for offshore, land-based, and distributed wind energy. WETO also supports research to understand wind-related siting and environmental challenges and to ensure reliable and resilient wind integration to the electric grid.

Building a clean and equitable energy economy while addressing the climate crisis is a top priority of the Biden Administration. This FOA will advance the Biden Administration's goals to achieve carbon pollution-free electricity by 2035 and to "deliver an equitable, clean energy future, and put the United States on a path to achieve net-zero emissions, economy-wide, by no later than 2050"[8] to the benefit of all Americans. The Department of Energy is committed to pushing the frontiers of science and engineering; catalyzing quality clean energy jobs through research, development, demonstration, and deployment (RDD&D); and ensuring environmental justice and inclusion of underserved communities.

Solar and wind energy technologies are essential to achieving a 100% clean electricity system by 2035 and a net-zero energy system by 2050. According to

[5] Section B.i provides more details on the range of grid services and applications considered in this FOA.
[6] SETO. SETO Multi-Year Program Plan. https://www.energy.gov/eere/solar/articles/solar-energy-technologies-office-multi-year-program-plan
[7] SETO. Solar Futures Study. https://www.energy.gov/eere/solar/solar-futures-study
[8] Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad," January 27, 2021.

the Solar Futures Study, solar power will need to grow from 3% of the U.S. electricity supply in 2020 to 40% by 2035 and 45% by 2050.[9] This will require the U.S. to install 30 gigawatts (GW_{ac}) of solar capacity each year between now and 2025 and ramp up to 60 GW_{ac} per year from 2025-2030. A similar amount of electricity will need to come from wind energy in 2035 and 2050. Accelerated wind deployment is also expected between now and 2035. It is worth noting that the Solar Futures Study investigated a 95% decarbonized grid by 2035, so the solar and wind values presented here will need to be even higher to achieve the Biden Administration's goal of a fully decarbonized electric grid by 2035. With supportive policies, electrification, and aggressive cost reductions, solar could provide 1 terawatt (TW_{ac}) of capacity to the grid by 2035 and 1.6 TW_{ac} of capacity by 2050 for a scenario resulting in CO2 emission reduction by 62%. Preliminary modeling shows that decarbonizing the entire energy system could result in the need for as much as 3 TW_{ac} of solar capacity due to increased electrification across the energy system.

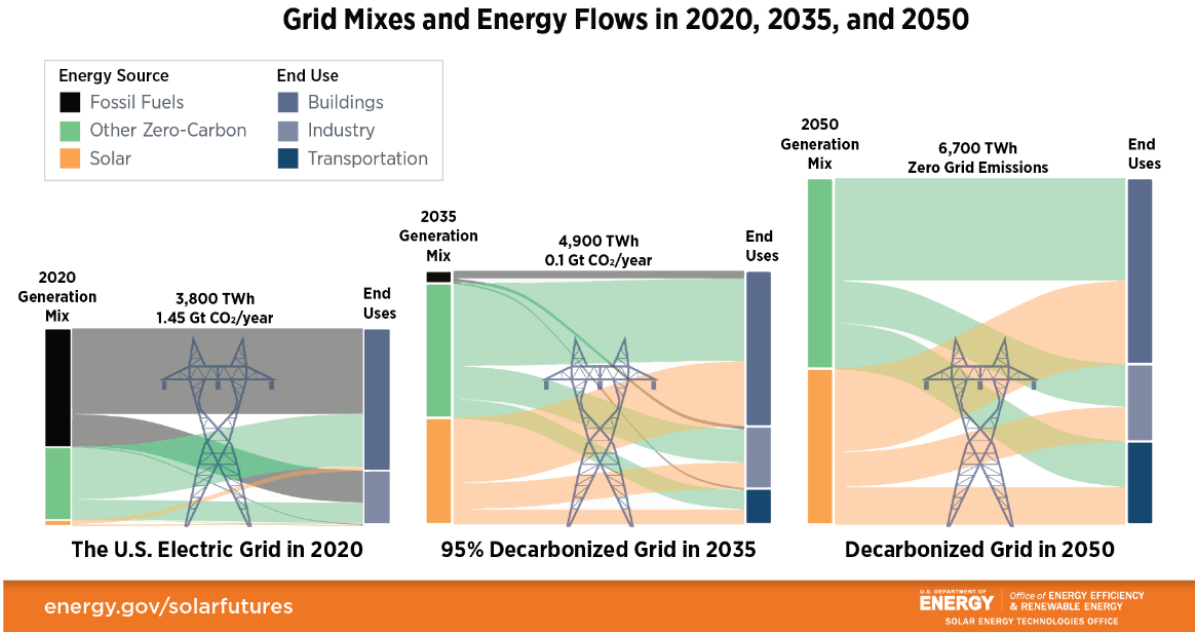

Figure 1: Solar power grows from 3% of the electricity mix in 2020 to 45% in 2050, serving more building, industry and transportation end uses in the decarbonization + electrification scenario. SOURCE: NREL/DOE Solar Futures Study

Achieving this transition requires that the industry achieve SETO's 2030 cost targets,[10] which would halve the cost of solar from 2020-2030. In many parts of the country, solar electricity is already the lowest-cost form of new electricity

[9] SETO. Solar Futures Study. https://www.energy.gov/eere/solar/solar-futures-study
[10] SETO. 2030 Solar Cost Targets. https://www.energy.gov/eere/solar/articles/2030-solar-cost-targets

generation capacity, but solar electricity is not yet cost-effective everywhere. There are multiple pathways to achieve these goals, but all require sustained innovation across solar energy technologies.

To achieve this transition, not only must solar generation be an economically viable alternative to traditional generation sources, it must also be a reliable source of electricity to maintain the quality of electricity service expected by the American people. To achieve a completely carbon-free bulk power system, renewable sources, including solar and wind generation and energy storage, must be able to support the grid during power and voltage fluctuations and disturbances. The research funded by this FOA will further develop and demonstrate technologies that maintain grid reliability and provide recommendations for how these technologies can be incorporated into grid operations. Additionally, the demonstrations hosted by this FOA will provide real-world system operation data to build evidence that the bulk power grid will continue to balance electricity supply and demand in real-time, maintain quality of service standards, and remain resilient to disturbances, even at times when the large majority of generation is supplied by solar and wind sources.

Decarbonization of the grid will not realize its full potential unless the resulting benefits are distributed equitably across all communities regardless of geography, demographics, and income level. Low-cost solar energy can help relieve energy burdens and provide clean, local electricity that can increase community resiliency across the country. Increasing equitable access to solar energy includes driving down the “soft” costs of solar energy, as well as developing business models like community solar that are designed to engage these communities that are less likely to adopt solar energy. Solar and wind generation are expected to greatly increase their role in energy production over the next decade, as access to renewable energy expands to more communities and creating good-paying jobs. These increases, along with the increased adoption of energy storage systems, will require a more advanced power system.

The research, development and demonstration (RD&D) activities to be funded under this FOA will support the government-wide approach to climate change by driving the innovation that can lead to an increase in the deployment of clean energy technologies. The projects funded by this FOA will demonstrate that renewable energy sources can support the reliable operation of a decarbonized grid. These projects will lead to the development of new technologies and strategic recommendations to bulk power system planners and operators on best practices to incorporate these technologies to ensure the safe and reliable

interaction between solar and wind resources and the bulk power system as it transitions to these cleaner electricity sources.

ii. Technology Space and Strategic Goals

As solar and wind energy systems become a larger proportion of nation's electricity supply, it is DOE's goal to ensure these technologies provide a reliable source of electricity. This funding opportunity will support EERE's near-term goal of demonstrating the reliable operation of a power system that has at up to 100% of its power contribution coming from solar, wind, and battery storage resources. This funding opportunity will support the development of control systems, strategies, and tools to ensure the grid's reliable operation when supplied primarily by these inverter-based resources (IBRs). These controls will be deployed at solar and wind plants and the tools and strategies developed by this research will be utilized by system planners and operators in various regions across the country who develop control and protection strategies, continually monitor the grid, and dispatch resources and control actions as needed.

In this context, reliability refers to the ability of the grid to supply all demand for electricity, which largely involves maintaining the voltage and frequency stability of the grid. Grid services, which are also called ancillary services, are some of the tools employed to maintain the reliability of the system. These services may be provided by generators intentionally reserving some of their generation capacity to respond when needed by the system, such as in response to a sudden loss of other generation, increase in load, or other cause for frequency deviation. Alternatively, non-generating resources such as synchronous condensers or grid-connected power electronic devices may supply other grid services such as supporting voltage levels. These services may be established contractually between transmission and generation operators or provided by independent operators responding to an electricity market. Grid services may be either automated or dispatched by a grid operator, depending on the application. Section B.i provides more details on the range of grid services and applications considered in this FOA.

Grid services have traditionally been supplied by synchronous machines, such as in gas turbine or hydropower plants. Because new wind and solar generation are IBRs, interfaced with the grid through a power electronic inverter, they have different characteristics and dynamics than synchronous machines. As the transmission systems begins to operate with fewer synchronous machines and more IBRs, these critical services that have been offset from traditional generation must now be provided by the IBR plants. Much work has already been done to develop the controls and methods for inverters to provide the needed grid services. Projects responding to Topic Area 1 of this FOA will further

support this development through long-duration demonstrations at existing large-scale wind and solar generation facilities connected to bulk power systems with high penetrations of IBR to show the capability of inverter-based resources to provide grid services at scale.

The transmission protection system is also employed by grid planners and operators to support grid reliability. This system automatically activates switching devices to separate healthy sections of the transmission grid from those experiencing disturbances. Disturbances may be electrical faults caused by the environment (trees, lightning, wildfires, animals, etc.), unstable power oscillations or other unsafe operating conditions. This system consists of measurement devices, control devices programmed to identify disturbances, and switching devices to reconfigure the grid and interrupt dangerous fault currents and unstable operating conditions. Communication networks are also employed in these protection systems to alert operators and perform coordinated switching operations across hundreds of miles.

The systems used to identify faults and other disturbances on the grid are largely based on the physics of the transmission system and the various sources and loads connected to it. These protection systems must continue to operate reliably as grid generation transitions away from synchronous machine-based generation towards IBRs. Projects responding to Topic Area 2 of this FOA will support this effort through improved large-scale studies of protection systems and IBRs responding to various fault scenarios and the development of technologies to ensure system reliability at any level of IBR generation.

Applicants will find descriptions of past funding efforts that EERE has made in each of these topic areas in Section B.

iii. Community Benefits Plan: Job Quality and Equity

To achieve the greatest impact for all Americans with this once-in-a-generation investment in infrastructure, it is critical that the BIL-funded projects not only contribute to the country's energy technology and climate goals, but also (1) support community and worker engagement; (2) invest in America's workforce; and (3) further DOE's equity, environmental and energy justice priorities; and (4) advance DOE's commitment to the Justice40 Initiative.[11]

To ensure these critical priorities are met, applications must include a Community Benefits Plan that illustrates how the proposed project will

[11] The Justice40 initiative, created by EO 14008, establishes a goal that 40% of the overall benefits of certain federal investments flow to DACs. https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf

incorporate the four priorities stated above. Within the Community Benefits Plan, the applicant must provide detail on how to ensure accountability, such as through the negotiation of a community benefits agreement (CBA) or other such agreement. These priorities are explained in more detail below. See Section IV.D.xvi for the Community Benefits Plan content requirements.

a. Community and Labor Engagement

The project planning should include engagement with an inclusive collection of local stakeholders such as residents and businesses, entities that carry out workforce development programs, labor unions and worker organizations, local government, and community-based organizations that support or work with disadvantaged communities. Considering the importance of the four priorities listed above and the financial investment in the projects to be funded under this FOA, stakeholder engagement is a relatively small cost that delivers high value. Proactive and meaningful engagement with stakeholders ensures stakeholders' perspectives can be incorporated into the project plan, allows for transparency, and helps reduce or eliminate certain risks associated with the project.

b. Quality Jobs

In keeping with the administration's goals[12], and to ensure the agency's energy projects contribute to overall economic prosperity, the DOE strongly supports investments that expand good-paying jobs, with assurances that workers will have a free and fair chance to join a union; promote worker power for marginalized workers and in hard-to-organize and changing industries; improve job quality through the adoption of strong labor standards; support responsible employers; and foster safe, healthy, and inclusive workplaces and communities free from harassment and discrimination, and support strategies that develop a skilled and inclusive local workforce to build and maintain the country's energy infrastructure and grow domestic manufacturing.

[12] Strengthening prosperity by expanding good-paying, secure, and safe union jobs accessible to all workers is a key goal set by President Biden, discussed in depth in his Executive Orders on Ensuring the Future Is Made in All of America by All of America's Workers (EO 14005), Tackling the Climate Crisis at Home and Abroad (EO 14008), Worker Organizing and Empowerment (EO 14025), Boosting Quality of Federal Construction Contracts (EO 14063), Promoting Competition in the American Economy (EO 14036), and Implementing the Infrastructure Investment and Jobs Act (EO 14052).

c. Diversity, Equity, Inclusion, and Accessibility

Advancing equity, civil rights, racial justice, and equal opportunity is a key priority of the Biden Administration. The term "equity" means the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment, such as Black, Latino, and Indigenous and Native American persons; Asian Americans and Pacific Islanders and other persons of color; members of religious minorities; lesbian, gay, bisexual, transgender, and queer (LGBTQ+) persons; persons with disabilities; persons who live in rural areas; and persons otherwise adversely affected by persistent poverty or inequality.[13]

As part of a whole of government approach to advancing equity, this FOA seeks to encourage the participation of underserved communities[14] and underrepresented groups and to ensure equitable access to business opportunities, good-paying jobs, career-track training, and other economic opportunities. Partnerships with community-based organizations, comprehensive support services to reduce barriers to opportunities, and ensuring business and employment opportunities for members of disadvantaged communities are key tools. Applicants are required to describe how diversity, equity, inclusion, and accessibility objectives will be incorporated in the project.

[13] Executive Order 13985, "Advancing Racial Equity and Support for Underserved Communities Through the Federal Government" (Jan. 20, 2021).

[14] The term "underserved communities" refers to populations sharing a particular characteristic, as well as geographic communities, that have been systematically denied a full opportunity to participate in aspects of economic, social, and civic life, as exemplified by the list of in the definition of "equity." E.O. 13985. For purposes of this FOA, communities identified as disadvantaged or underserved communities by their respective States; communities identified on the Index of Deep Disadvantage referenced at https://news.umich.edu/new-index-ranks-americas-100-most-disadvantaged-communities/, and communities that otherwise meet the definition of "underserved communities" stated above.

Further, applicants are highly encouraged to include individuals from groups historically underrepresented[15,16] in STEM on their project teams.

Minority Serving Institutions,[17] Minority Business Enterprises, Minority Owned Businesses, Woman Owned Businesses, Veteran Owned Businesses, Tribal Colleges and Universities, or entities located in an underserved community that meet the eligibility requirements (See Section III) are encouraged to apply as the prime applicant or participate on an application as a proposed partner to the prime applicant. The Selection Official may consider the inclusion of these types of entities as part of the selection decision (See Section V.E.i. Program Policy Factors).

d. Justice40 Initiative

In addition to the Federal government's initiative to achieve greater participation from underserved communities and underrepresented groups, this FOA supports the goal that 40% of the overall benefits of certain investments flow to disadvantaged communities to support DOE's commitment to the Justice40 Initiative.[18] Benefits include (but are not

[15] According to the National Science Foundation's 2019 report titled, "Women, Minorities and Persons with Disabilities in Science and Engineering", women, persons with disabilities, and underrepresented minority groups—blacks or African Americans, Hispanics or Latinos, and American Indians or Alaska Natives—are vastly underrepresented in the STEM (science, technology, engineering and math) fields that drive the energy sector. That is, their representation in STEM education and STEM employment is smaller than their representation in the U.S. population. https://ncses.nsf.gov/pubs/nsf19304/digest/about-this-report For example, in the U.S., Hispanics, African Americans and American Indians or Alaska Natives make up 24 percent of the overall workforce, yet only account for 9 percent of the country's science and engineering workforce. DOE seeks to inspire underrepresented Americans to pursue careers in energy and support their advancement into leadership positions. https://www.energy.gov/articles/introducing-minorities-energy-initiative

[16] See also. Note that Congress recognized in Section 305 of the American Innovation and Competitiveness Act of 2017, Public Law 114-329:

> (1) [I]t is critical to our Nation's economic leadership and global competitiveness that the United States educate, train, and retain more scientists, engineers, and computer scientists; (2) there is currently a disconnect between the availability of and growing demand for STEM-skilled workers; (3) historically, underrepresented populations are the largest untapped STEM talent pools in the United States; and (4) given the shifting demographic landscape, the United States should encourage full participation of individuals from underrepresented populations in STEM fields.

[17] Minority Serving Institutions refers to universities and colleges that serve a significant percentage of students from minority groups, including Historically Black Colleges and Universities/Other Minority Institutions as educational entities recognized by the Office of Civil Rights (OCR), U.S. Department of Education, and identified on the OCR's Department of Education U.S. accredited postsecondary minorities' institution list. See https://www2.ed.gov/about/offices/list/ocr/edlite-minorityinst.html.

[18] The Justice40 initiative, created by E.O. 14008, establishes a goal that 40% of the overall benefits of certain federal investments flow to (DACs). The Justice40 Interim Guidance provides a broad definition of DACs (Page 2): https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf. The DOE, OMB, and/or the Federal

limited to) measurable direct or indirect investments or positive project outcomes that achieve or contribute to the following in disadvantaged communities: (1) a decrease in energy burden; (2) a decrease in environmental exposure and burdens; (3) an increase in access to low-cost capital; (4) an increase in quality job creation, the clean energy job pipeline, and job training for individuals; (5) increases in clean energy enterprise creation and contracting (e.g., minority-owned or disadvantaged business enterprises); (6) increases in energy democracy, including community ownership; (7) increased parity in clean energy technology access and adoption; and (8) an increase in energy resilience.

iv. Cross-Office Coordination

SETO collaborates with EERE's Wind Energy Technologies Office (WETO) to competitively select and fund projects that demonstrate the viability of wind and solar resources to rapidly integrate with the nation's electric grid in an affordable and reliable manner to achieve the goal of decarbonizing the electricity sector.

EERE, together with the DOE Office of Electricity and the Office of Clean Energy Demonstrations, engages with regional and local partners, to develop, demonstrate, and deploy innovative technologies and to conduct community planning that enhances resilience against physical hazards, leveraging distributed solar generation, energy storage, EVs, and other distributed energy resources. The research and demonstrations funded by this FOA will further increase electricity resilience for disadvantaged communities and allow for more energy to be provided by clean resources.

v. Priority Research Areas

The *Solar and Wind Grid Services and Reliability Demonstration* FOA focuses on the research, development, and demonstration of clean energy technologies on the bulk power grid. The objective is to improve the reliability, resilience, safety, and security of the operation of the bulk power grid while simultaneously allowing for a greater amount of wind and solar energy at a reduced cost to be connected to the grid. To accomplish these objectives, SETO is interested in the following two topic areas:

1. WIND AND SOLAR GRID SERVICES DESIGN, IMPLEMENTATION AND DEMONSTRATION. This topic area supports demonstration projects that integrate renewable generation with other large-scale or aggregated

Council for Environmental Quality (CEQ) may issue additional and subsequent guidance regarding the designation of DACs and recognized benefits under the Justice40 Initiative.

distributed energy resource (DER) technologies to provide grid services. Successful projects will: (1) identify barriers and opportunities for various combinations of solar, wind and energy storage resources with or without other aggregated DERs to provide grid services; (2) research and develop grid services solutions offered by these technologies; and (3) design, develop and implement central, local or hybrid controls with large-scale field demonstrations of these grid services. The projects will also need to define and validate the technology and deployment specifications required for the proposed solutions to ensure reliable and resilient planning and operations of electric grids with high generation contribution from IBRs.

2. PROTECTION OF BULK POWER SYSTEMS WITH HIGH CONTRIBUTION FROM INVERTER-BASED RESOURCES. This topic area seeks to support the development of power system protection strategies for the bulk power electric transmission system as it transitions to and operates under scenarios where the majority of electrical generation is provided by IBRs. Projects in this area will investigate how existing protection devices are impacted by the behavior of IBRs responding to grid disturbances, such as faults. The goal of this topic area is to advance modeling and simulation capabilities to perform protection studies in high IBR penetration scenarios to develop a better understanding of how the protection systems will operate in these future scenarios. Additionally, projects in this topic area will develop strategies and new technologies to maintain system protection at any level of IBR penetration. Validating these studies and technologies through laboratory testing, or preferably field demonstrations, will lead to improved confidence in the transmission system protection, operation, and planning industry that the grid can operate safely and reliably at any mix of synchronous and IBR generation, including up to 100% IBR generation.

Projects funded by EERE are expected to produce high-impact outcomes with a view toward commercialization and wide dissemination, including publication of the results in high-visibility, high-impact, peer-reviewed journals.

vi. Teaming Partner List

Under all topics of this FOA, teams that include multiple partners are preferred over applications that include a single organization. Teams are encouraged to include representation from diverse entities, such as Historically Black Colleges and Universities (HBCU) or Minority Serving Institutions (MSI), or through linkages with Opportunity Zones, and well as with relevant labor unions where appropriate. To facilitate the formation of teams, EERE is providing a forum where interested parties can add themselves to a Teaming Partner List, which

allows organizations that may wish to apply to the FOA but not as the prime applicant, to express interest to potential partners.

The Teaming Partner List and instructions will be available at https://www.energy.gov/eere/solar/articles/funding-notice-solar-and-wind-grid-services-and-reliability-demonstration, as well as on EERE eXCHANGE, during the FOA application period. The list will be updated at least weekly until the close of the full application period, to reflect new teaming partners who have provided their information.

> **Disclaimer:** By submitting a request to be included on the Teaming Partner List, the requesting organization consents to the publication of its contact information. By enabling and publishing the Teaming Partner List, EERE is not endorsing, sponsoring, or otherwise evaluating the qualifications of the individuals and organizations that are identifying themselves for placement on this Teaming Partner List. EERE will not pay for the provision of any information, nor will it compensate any applicants or requesting organizations for the development of such information.

Applicants should indicate which topic area they are interested in within the Teaming Partner List. Each topic area has specific team partner requirements. See the requirements table in each topic in Section B for these requirements.

B. Topic Areas

i. Topic Area 1: Wind and Solar Grid Services Design, Implementation, and Demonstration

Background and Context

The grid services for the electric power system are traditionally defined as ancillary services, such as power regulation and frequency response, spinning and non-spinning reserves, etc., to support the reliable and stable operations of electric power systems.[19,20] They are used by vertically integrated utilities and regional transmission system operators to support the real-time balance of

[19] NESCOE. August 2016. "Electricity Ancillary Services Primer." https://nescoe.com/resource-center/ancillary-services-primer-sep2017/

[20] NREL. May 2011. "Electric Market and Utility Operation Terminology." https://www.ferc.gov/sites/default/files/2020-05/rm95-8-00w.txt

electric loads with supply from generation units. In its Order No. 888 in 1996, the Federal Energy Regulatory Commission (FERC) stated that six services must be offered in "open access non-discriminatory transmission tariffs."[21] These were: (1) Scheduling, system control, and dispatching; (2) Reactive supply and voltage control from generation resources (3) Regulation and frequency response; (4) Energy imbalance; (5) operating (spinning) reserve; and (6) Operating (supplemental) reserve services.[21]

Over the course of power market deregulation, Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs) introduced several market products and services to ensure economic and efficient operations while maintaining reliability and stability. [22,23] These markets and their products are still evolving as the generation mix and other societal needs change.[24,25]

Over time, the number and definition of grid services have also significantly evolved. In late 2016, a paper published by the North American Electric Reliability Corporation (NERC) recommended three essential reliability services deemed necessary for managing frequency, voltage, net area demand and dispatchability: (1) Frequency support, (2) Ramping and balancing, and (3) Voltage support.[26] This paper also explored reliability challenges that may arise from the changing generation resource mix and recommended sufficiency guidelines for the bulk power system (BPS). Reference 24 provides a good summary of different grid service products and their names as adopted by different ISOs/RTOs in the United States.

It is beyond the purpose of this section to provide a uniform and comprehensive list of grid services for electric power systems. Literature in electric power systems provides ample detail on the subject. One such research project by the Grid Modernization Laboratory Consortium (GMLC) lists the taxonomy on traditional grid services, as shown in Figure 2.[27]

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[21] FERC. April 1996. "ORDER NO. 888: FINAL RULE." https://www.ferc.gov/sites/default/files/2020-05/rm95-8-00w.txt

[22] K. Cleary & K. Palmer. March 2020. "US Electricity Markets 101." https://www.rff.org/publications/explainers/us-electricity-markets-101/

[23] Purdue. "Electric Utilities, Deregulation and Restructuring of U.S. and Restructuring of U.S. Electricity Markets." https://www.purdue.edu/discoverypark/energy/assets/pdfs/History.pdf

[24] NREL. Y. Sun et al. May 2021. "Research Priorities and Opportunities in United States Competitive Wholesale Electricity Markets." https://www.nrel.gov/docs/fy21osti/77521.pdf

[25] DOE, EAC. October 2019. "Optimizing Reserves." https://www.energy.gov/sites/default/files/2019/10/f68/EAC_Optimizing%20Reserves%20%28October%202019%29.pdf

[26] NERC. December 2016. "Essential Reliability Services."

[27] PNNL. N. Samaan et al. June 2017. "Grid Services Master List."

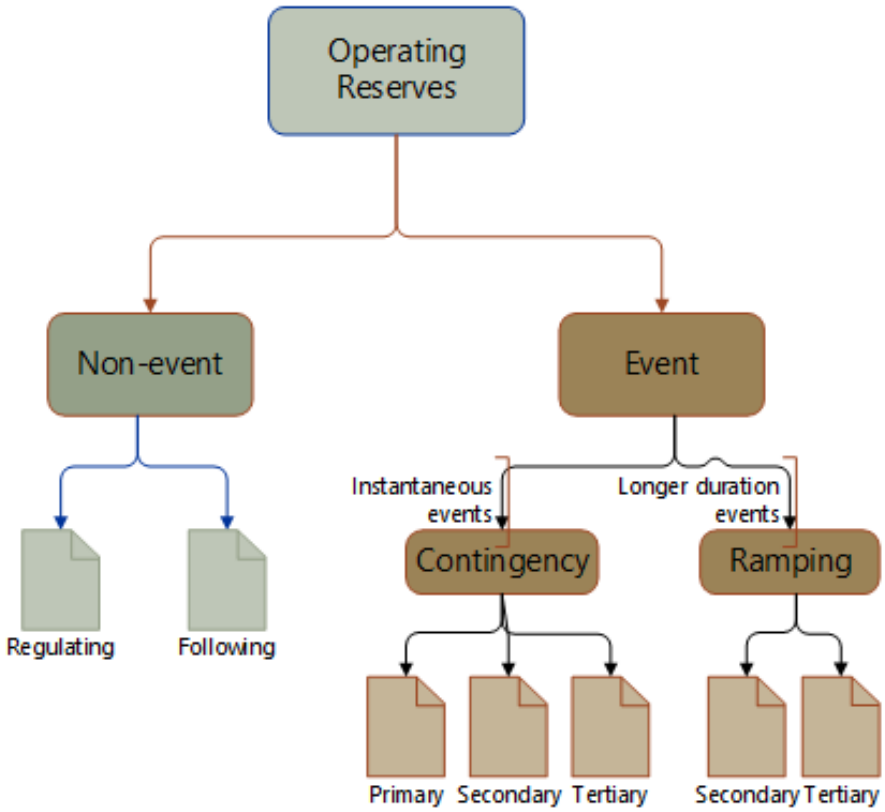

Figure 2. Categories of traditional ancillary or grid Services

The lists published in this reference and several others also propose (new) emerging services some of which are shown in Figure 3.[28,29,30, 31,32] These references extend grid services to incorporate distributed energy resources (DERs) located on distribution networks beyond transmission. Some also provide compensation approaches and performance requirements for each service at various ISOs/RTOs. They offer market opportunities for (aggregated) distributed

[28] EPRI. July 2021. "Grid Services in the Distribution and Bulk Power Systems: A Guideline for Contemporary and Evolving Service Opportunities for Distributed Energy Resources." https://www.epri.com/research/products/000000003002022405

[29] C. S. et al. September 2020. "Ancillary Services Offered by Distributed Renewable Energy Sources at the Distribution Grid Level: An Attempt at Proper Definition and Quantification." https://www.mdpi.com/2076-3417/10/20/7106

[30] LBNL. F. Kahrl et al. October 2021. "Variable Renewable Energy Participation in U.S. Ancillary Services Markets: Economic Evaluation and Key Issues." https://emp.lbl.gov/publications/variable-renewable-energy

[31] NREL. E. Ela et al. August 2011. "Operating Reserves and Variable Generation." Operating Reserves and Variable Generation

[32] LBNL. A. D. Mills et al. February 2021. "Solar-to-Grid: Trends in System Impacts, Reliability, and Market Value in the United States with Data Through 2019." https://emp.lbl.gov/publications/solar-grid-trends-system-impacts

energy resources and summarize attributes of such services already being tried at some of the ISOs/RTOs.

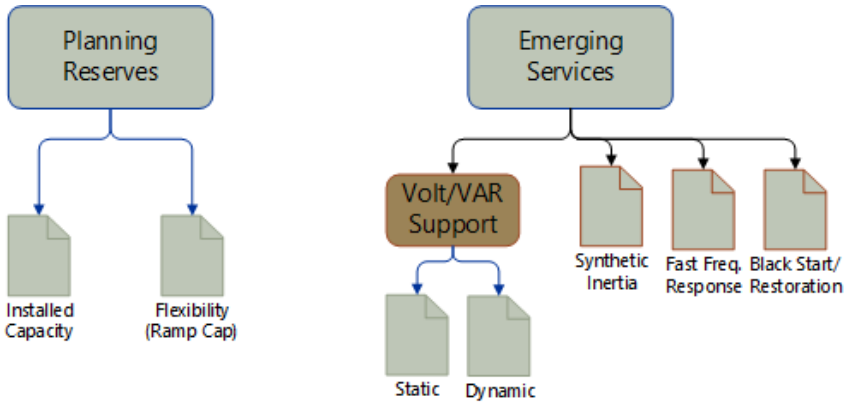

Figure 3. Categories of new emerging services.

The trends in solar and wind generation are fundamentally changing the traditional planning and operations of the electric power grids. As solar and wind generation combined with storage increase, additional opportunities for these resources to provide grid services are presented. Figure 4 shows the percentage of combined instantaneous power from wind and solar generation operating in 2019 at various locations around the country and the percentage of annual energy supply they provided. The frequency of high instantaneous power supply from wind and solar generation has also been increasing in recent years.[33,34,35,36,37] Solar generation can provide instantaneous power values at least two to three times higher than annual energy supply, and wind has three to four times higher values, due to plant capacity factors and diurnal and seasonal variations. These high instantaneous IBR power levels may cause challenges in system stability and their high annual energy contributions may present problems managing other energy resources.

Grid services are traditionally provided by synchronous generators, but it has been demonstrated that solar and wind plants can also provide these services.

[33] Hawaiian Electric. December 2020. "Power Facts." https://www.hawaiianelectric.com/documents/about_us/company_facts/power_facts.pdf
[34] EIRGRID Group. November 2021. "Renewable Energy." http://www.eirgridgroup.com/how-the-grid-works/renewables/
[35] CAISO. November 2021. " Renewables and Emission Reports." http://www.caiso.com/market/Pages/ReportsBulletins/RenewablesReporting.aspx
[36] Southwest Power Pool. 2019. "2019 Annual Report. Integration." https://www.spp.org/documents/62057/2019%20annual%20report%2020200428%20web.pdf
[37] ERCOT. December 2021. "Combined Wind and Solar." https://www.ercot.com/gridmktinfo/dashboards/combinedwindandsolar

FERC, in its Order 842, requires "newly interconnecting large and small generating facilities, both synchronous and non-synchronous, to install, maintain, and operate equipment capable of providing primary frequency response as a condition of interconnection."[38] In the past several years, SETO and WETO have funded projects that have demonstrated that some grid services can be provided through solar and wind resources. Sponsored by SETO, a team led by the California Independent System Operator (CAISO) demonstrated that a large-scale solar power plant can provide a wide range of grid services.[39] With support from WETO, a team led by Avangrid conducted a series of feasibility tests at Tule Wind Farm, located near San Diego.[40] The tests determined a large-scale wind plant can provide various grid services to support grid frequency and voltage at different operating conditions. However, since IBRs can generally provide faster control responses than synchronous generators, further research and validation are needed for grid services by large-scale renewable plants and/or aggregated DERs.

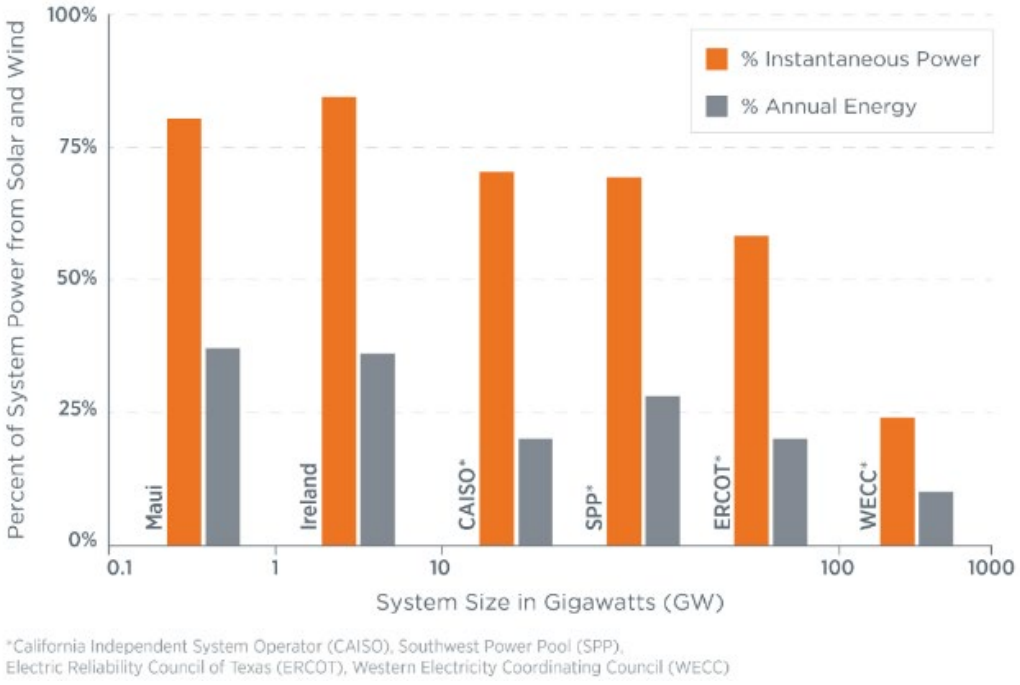

Figure 4. Percent of system power from solar and wind generation (2019).

[38] FERC. February 2018. "Order No. 842 Essential Reliability Services and the Evolving Bulk-Power System—Primary Frequency Response." https://www.ferc.gov/sites/default/files/2020-06/Order-842.pdf

[39] NREL. C. Loutan et al. March 2017. "Demonstration of Essential Reliability Services by a 300-MW Solar Photovoltaic Power Plant." https://www.nrel.gov/docs/fy17osti/67799.pdf

[40] CASIO. C. Loutan et al. "Demonstration of Capability to Provide Essential Grid Services." https://www.caiso.com/Documents/WindPowerPlantTestResults.pdf

There are some other research projects on the feasibility of coupling of solar, wind and energy storage resources to provide grid services using hybrid control strategies.[30,41] However, there are still many challenges and gaps to be resolved. Large-scale solar and wind plants typically operate at their maximum capacity and use, storage and other technologies only to minimize their curtailment. More sophisticated coupling of these new technologies, empowered with fast centralized, local, and/or hybrid control optimization strategies are needed to test and verify their functionality and value to the system. [42,43] Additionally, to be implemented in practice, market structures, incentives, or rate cases may need to be developed to compensate for wind and solar plants to operate below full capacity in order to provide grid services. The development of these incentives is beyond the scope of this topic, but this topic will include a cost-benefit analysis of these grid services.

Topic Objectives

SETO and WETO plan to fund field demonstrations that integrate a combination of solar, wind, storage, and/or aggregated distributed energy resource (DERs) using centralized and/or local controls to provide grid services. This section covers the primary focus and goals of this topic area, as well as technical requirements for the field demonstrations.

Electric power system operators and planners need to gain confidence that inverter-based resources, such solar and wind generation, and/or storage plants and other aggregated DERs can provide grid services over extended periods of time under several different conditions as a seamless part of the larger grid. The demonstration size of the plants participating in providing these services needs to be large enough to set precedents for designing and introducing new tariff requirements, contract options, and electric power market products. Such demonstrations need to be implemented under conditions where the instantaneous penetration of renewables is high enough to provide confidence in reaching the renewable and clean energy targets adopted by the federal

[41] CAISO. June 2019. "2019 Annual Report on Market Issues and Performance." http://www.caiso.com/Documents/2019AnnualReportonMarketIssuesandPerformance.pdf

[42] DOE. "Solar Integration: Inverter and Grid Services Basics." https://www.energy.gov/eere/solar/solar-integration-inverters-and-grid-services-basics

[43] NERC. March 2021. "Reliability Guideline: Performance, Modeling, and Simulations of BPS-Connected Battery Energy Storage Systems and Hybrid Power Plants." https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Reliability_Guideline_BESS_Hybrid_Performance_Modeling_Studies_.pdf#search=BESS

government[44] and many states.[45] See Table 2 for a list of requirements for the demonstration projects applying to this topic area. These projects should provide sufficient historical data and experience to derive robust requirements for telecommunications infrastructure needed for real-time response from the solar and/or wind generation units participating in the projects. Several different optimization strategies should be tested to ensure that these units can follow the central control signals from the utility or the ISO/RTO within small allowable tolerances.

Successful applications are expected to combine at least 10 MW of solar, wind, storage and/or aggregated DERs to provide traditional and emerging grid services. These projects will need to develop centralized and/or autonomous local controls that demonstrate the feasibility of the proposed solutions over a well-defined field validation process and period, which will last no less than 6 months.

For this topic, the grid services to be provided by renewable generation and/or aggregated distributed energy resources include, but are not limited to, the following services:

Table 1: Grid Services

Grid Service Category	Grid Service Product Name	Control Action	Control Purpose
Non-event Operating Reserves	Regulating	Automatic generator control (AGC) within optimal dispatch	Correct the current area control error (ACE)
	Following	Manual (part of optimal dispatch)	Correct the anticipated ACE
Event-Based Operating Reserves	Contingency (in response to instantaneous events)	Primary	Stabilize frequency
		Secondary	Return frequency to nominal and/or ACE to zero
		Tertiary	Replace primary and secondary
	Ramping (in response to long events)	Secondary	Return frequency to nominal and/or ACE to zero
		Tertiary	Replace secondary
Planning Reserves	Installed available capacity	N/A	Adequate capacity within the system above the forecast system peak load

[44] Washington Post. July 2020. "Biden calls for 100 percent clean electricity by 2035. Here's how far we have to go." https://www.washingtonpost.com/climate-environment/2020/07/30/biden-calls-100-percent-clean-electricity-by-2035-heres-how-far-we-have-go/

[45] Energysage. May 2020. "100 percent renewable targets." https://news.energysage.com/states-with-100-renewable-targets/

	Installed available flexibility	N/A	Mitigation of potential impacts of variability and uncertainty
Emerging Services for IBR	"Synthetic" inertia	Local autonomous control or an effective equivalent	a.k.a. inertia-based response, equivalent inertia. An extremely fast frequency response to instantaneously slow initial ROCOF
	Fast frequency response	Primary	Rapid injection or absorption of power in response to changes in frequency
	Voltage/reactive support (steady state and dynamic)	Dependent on the function	steady-state and dynamic management of voltage levels
	Black start/ Restoration	Dependent on the function	Black start, restoration of the BPS

The projects will need to:

- Develop detailed technical requirements and outline procedures for participating in the grid services to be demonstrated.
- Design and implement in the field demonstration the centralized and/or local optimization strategies for the generation units in their portfolio. Controls at the inverter level and plant level must be fully designed, implemented, and field tested.
- Design and implement in the field demonstration all the necessary monitoring and control infrastructure.
- Design and propose appropriate valuation methods for the demonstration, if not already in place. These should be used in an economic analysis of the demonstration site over the course of the testing period.
- Demonstrate the grid services of interest are able to respond in accord with control signals from the utility or ISO/RTO.
    - If the design will include more than one distributed energy resource, the aggregated response and their interactions may also need to be verified to ensure proper coordination between multiple entities when providing various combinations of grid services.
- Develop and document the design and implementation of resource management, data communications, and grid operations.
    - Resource management should focus on resource aggregation to formulate manageable control and trading entities (if proposed) that fit into the overall utility or ISO generation or grid service participation process; forecasting required and implemented to improve both temporal and spatial accuracy in energy availability (if not already in place); resource optimization by considering opportunities and overall costs and benefits; and reliable responses and executions to dispatching commands.

  - The data communication system needed for secure and fast data transfer between resources and the system operator by connecting data collection module, data monitoring subsystems, resource analysis modules, dispatching modules, resource control subsystems, and other functional modules on both the resource side and the system side, if required by the design and not already in place.
  - Grid operation functions focused on integrating the proposed resource(s) into overall system planning by the utility or ISO, trading (if proposed) and control processes, functions and platforms. These functions would typically include resource integration, service request and registration, service participation evaluation, cost calculation, dispatching decisions, trading submission (if relevant), record saving and retrieving, as well as command issue and acknowledgment to and from the resources.
- Conduct a cost-benefit analysis utilizing the data collected before and during the demonstration to quantify the value of such services using similar service contracts and/or power system market clearing prices for the product. The cost-benefit analysis along with the performance requirements variables would be used as the main input for the analysis of the economic barriers for the proposed grid services. These in turn would be shared with the power systems operations and planning stakeholders to increase their confidence in using solar and wind generation technologies for complementing system operations.
- Identify how the demonstrated grid service technologies may impact the interconnection study process:
  - Identify new simulations or studies that may be needed during the interconnection process for solar and wind plants that can provide grid services.
  - Identify improvements that could be made to interconnection study tools or software to perform studies that account for grid services more efficiently.

Project Requirements

Table 2 below provides a summary of general project requirements.

Table 2: Project Requirements

Features	Requirements
Utility or ISO size	• Bulk power systems size: ≥ 200 MW for traditional services demonstration • Bulk power system size: ≥ 50MW for emerging services demonstration
(Aggregated) Plant size	• Combined wind/ solar/ storage/ aggregated DERs ≥ 10 MW
Renewable penetration	• Instantaneous (hourly or 15-min time intervals) renewables and aggregated DERs penetration level ≥ 50% up to 100% for 25% of demonstration period
Minimum other DERs aggregation	• Roof top PV, demand-side management (DMS), etc. ≥ 10 MW
Hardware-in-the-loop simulations	• ≥ 15 min, 24 hour, 6-month simulations, required • ≥ 5 min, 24 hour, 12-month simulations, recommended
Demonstration period	• ≥ 6 months, required • ≥ 12 months, recommended
Energy resource types	• Wind or solar with or without storage, required • Wind and solar with storage, recommended
Integration	• Following a central control signal individually, required • Following a central control signal collectively, with autonomous controls • If collective, design and implementation of control dispatch and related monitoring and data management requirements.
Scalability	• Demonstration of ability to scale up the technologies and implementations to larger systems and higher renewable penetrations
Security	• Compliance with the latest power system's communication, controls and cyber security standards
Market structure	• Vertically integrated or deregulated electric power market structure
Cost-benefit analysis	• Data collection during demonstration period to perform a detailed cost-benefit analysis for proposed grid services
Team partners	• Utility (including investor-owned, municipal, or co-operative, of any size that meets the minimum requirements listed in this table) or ISO, and solar or wind asset owner(s), required • Utility or ISO, and solar, wind, battery asset owners and aggregators, recommended • Teams are strongly encouraged to include community colleges, Tribal colleges, MSIs, or other institutes that do not typically engage in power systems research as project partners or to be engaged in project activities, in an effort to increase the diversity of people exposed to this field of study

Applications Not of Interest for Topic 1

- Applications that primarily focus on system modeling, simulations and study of renewable energy resources.
- Applications from companies seeking the full or incremental funding of an existing or a new project for installation.
- Projects with micro-grid field demonstrations for traditional services.

ii. Topic Area 2: Protection of Bulk Power Systems with High Contribution from Inverter-Based Resources

Background and Context

To achieve the administration's goal of a decarbonized electricity grid, solar and wind generation are expected to greatly increase their role in energy production over the next decade. These increases, along with the increased adoption of energy storage systems, will result in a power system that will transition from one supplied primarily by synchronous generators to a system that will be supplied primarily by resources that are interfaced with the grid through power electronic inverters. The industries supporting the bulk power grid must be prepared for how this transition may change the operation of the transmission system, such as how the grid architecture and protection devices, software, and processes that secure the grid will respond to abnormal conditions when energy is sourced primarily from inverters. In this topic, any type of generation interfaced to the grid through an inverter is referred to as an inverter-based resource (IBR), since the inverter connection is the most relevant change when it comes to the subjects of this topic. However, it should be noted that the energy source behind the inverter may be relevant to the overall dynamic response or energy availability of IBRs.

In the past, when IBRs comprised a small contribution to the grid, interconnection standards dictated they disconnect during faults or abnormal conditions to not interfere with the recovery process. Over the past decade, IBRs have become a significant enough contributor to the grid that they must instead actively support the grid in these conditions to avoid further destabilizing the grid.[46,47] New standards[48,49] have been and are continuing to be developed to enable IBRs to actively support the grid in the event of a fault or other issue. However, in the event of a fault, these standards assume that the appropriate

[46] NERC. 1200 MW Fault Induced Solar Photovoltaic Resource Interruption Disturbance Report. June, 2017. https://www.nerc.com/pa/rrm/ea/1200_MW_Fault_Induced_Solar_Photovoltaic_Resource_/1200_MW_Fault_Induced_Solar_Photovoltaic_Resource_Interruption_Final.pdf

[47] NERC. April and May 2018 Fault Induced Solar Photovoltaic Resource Interruption Disturbances Report. January, 2019. https://www.nerc.com/pa/rrm/ea/April_May_2018_Fault_Induced_Solar_PV_Resource_Int/April_May_2018_Solar_PV_Disturbance_Report.pdf

[48] IEEE. IEEE 1547-2018 - Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces. April, 2018. https://standards.ieee.org/standard/1547-2018.html

[49] IEEE. IEEE 2800-2022 – IEEE Standard for Interconnection and Interoperability of Inverter-Based Resources (IBR) Interconnecting with Associated Transmission Electric Power Systems. April, 2022. https://standards.ieee.org/project/2800.html

protection system will correctly operate and remove the fault causing the abnormal condition as quickly as possible. As the generation sources become increasingly inverter-based, it is unclear if protection systems will perform as expected since most of these systems have been designed on the basis of synchronous generation.

Emerging Challenges

Protection challenges exist for faults occurring on the grid at both transmission and distribution levels. The impact of IBR on distribution protection is better understood due to recent research efforts, therefore, this topic will focus on IBR-related impacts to transmission protection. Several challenges to transmission protection linked to the increased penetration of IBRs have already been observed. The most prominent instances to date have been due to the general lack of coordination between the design of grid protection systems and IBR controls or the misunderstanding of how IBRs will respond to faults. These challenges have already been shown to lead to unnecessary losses in generation that further increase reliability risks.[50]

In the event shown in Figure 5, the Electric Reliability Council of Texas (ERCOT) interconnection lost nearly a quarter of its PV generation in response to a fault for which many of the IBRs should have remained connected.[51] The inverters tripped offline for a variety of reasons, such as loss of synchronization with the grid, internal and grid-side overvoltage, and underfrequency. However, it is speculated that proper modeling and simulation of the IBR controls in conjunction with the grid protection system would likely have foreseen these issues in protection studies performed during the IBR's interconnection. Proper tuning of IBR control and protection parameters may have then prevented many of these disconnections.

[50] NERC. San Fernando Disturbance. November, 2020. https://www.nerc.com/pa/rrm/ea/Documents/San_Fernando_Disturbance_Report.pdf

[51] NERC. Odessa Disturbance. September, 2021. https://www.nerc.com/pa/rrm/ea/Documents/Odessa_Disturbance_Report.pdf

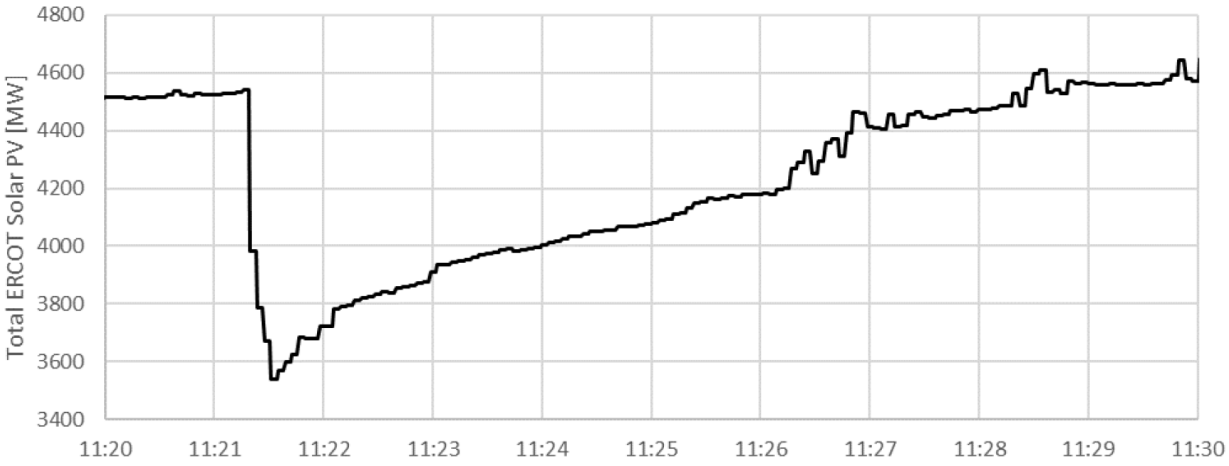

Figure 5. Significant loss of BPS-connected PV generation in ERCOT during a fault.

In fact, several blackout or large-scale load-shedding events have already occurred in other regions due to unexpected loss of generation during periods of high-IBR generation.[52,53] While policy changes may address some of these challenges, improvements to software and modeling for protection studies are needed to ensure the coordination of IBRs and the grid protection system as well as for improving the efficiency of the interconnection study process, especially when it comes to system protection.[54]

Other instances have been observed where the nature of the output of IBRs during a fault has caused misoperations in the existing grid protection systems. A well-recognized difference between the response of an IBR and a synchronous generator to a fault is that the IBR will supply a much lower short-circuit current magnitude due to the current-limiting nature of IBRs. A synchronous generator will typically output about 6.0 p.u. of its rated current for several cycles before reducing to 2.0 – 4.0 p.u. in steady-state during a fault. An IBR on the other hand will have a brief transient current of 2.0 – 5.0 p.u. for less than ¼ of a cycle before returning to 1.0 – 2.0 p.u. rated current in steady-state during the fault.[55] However, the amount of IBR fault or short-circuit current can vary significantly by the specific design and control of an inverter. This is complicated by the variable nature of renewable resources behind inverter devices. More

[52] AEMC. Mechanisms to Enhance Resilience in the Power System – Review of the South Australian Black System Event. December, 2019. https://www.aemc.gov.au/sites/default/files/documents/aemc_-_sa_black_system_review_-_final_report.pdf

[53] OFGEM. 9 August 2019 Power Outage Report. January, 2020. https://www.ofgem.gov.uk/sites/default/files/docs/2020/01/9_august_2019_power_outage_report.pdf

[54] https://insideclimatenews.org/news/02022022/pjm-solar-backlog-eastern-power-grid/

[55] NREL, J. Keller, B. Kroposki, "Understanding Fault Characteristics of Inverter-Based Distributed Energy Resources," January, 2010. https://www.nrel.gov/docs/fy10osti/46698.pdf

comprehensive protection studies or adaptive protection schemes could address such issues. However, it is not conclusive that short-circuit values will universally decline across a transmission grid supplied mostly by IBR.[56] Some areas of the transmission grid may have short-circuit characteristics that are determined primarily by line and transformer impedances rather than the mix of generation.

Another underlying difference in the response of IBRs to faults compared to synchronous generators is that BPS-connected IBRs, as they are typically controlled today, suppress their output of negative sequence current. Negative-sequence current is a mathematical representation of how far from balanced three-phase operation a generator is producing current and protection engineers use it as an important quantity to identify unbalanced faults in the system. One application is to simply trigger a relay to operate a breaker if too much negative sequence current is measured (negative sequence overcurrent) as an indication of an unbalanced fault. The study by EPRI in Reference 57 provides a detailed description of how IBR produce a much lower magnitude of negative-sequence current compared to an equivalent sized synchronous generator.[57] This study also includes examples of how typical negative sequence overcurrent settings will fail to operate when the fault current is supplied primarily by IBR versus synchronous generators. These findings indicate a more careful application of settings must be applied to relays depending on the mix of sources supplying a fault. This complicates the development of protection settings and may even necessitate adaptive settings if the resource mix fluctuates. A further complication is that the aggregate impact of distributed IBRs on the transmission grid (if allowed to feed into the transmission grid) will have less predictable negative-sequence (and possibly zero-sequence) responses to faults than large grid-tied IBRs due to their unbalanced nature.

Besides directly triggering on overcurrent, other protection applications use negative sequence voltage and current as important references in their operation. It has been observed that relays on transmission lines can fail to properly identify fault current direction in high-IBR penetration scenarios.[58] The current direction calculation may fail for several reasons. The relay may require a minimum threshold of negative-sequence current before it uses the direction calculation, which would fail if the threshold were set too high. Another reason is that the calculation may rely on the relationship between negative sequence

[56] IEEE. Impact of Inverter Based Generation on Bulk Power System Dynamics and Short-Circuit Performance. September, 2018. https://resourcecenter.ieee-pes.org/publications/technical-reports/PES_TR_7-18_0068.html
[57] EPRI. Impact of Inverter-Based Resources on Protection Schemes Based on Negative Sequence Components. July, 2019. https://www.epri.com/research/products/000000003002016197
[58] IEEE, M. Nagpal, C. Henville, "Impact of Power-Electronic Sources on Transmission Line Ground Fault Protection," May, 2017. https://ieeexplore.ieee.org/document/7935410

voltage and current that is typical for a synchronous generator, but is different for IBRs. Determining fault current direction is crucial to many protection schemes, particularly distance protection schemes that are commonly deployed on many transmission lines. An error in this calculation could lead to relays calculating a fault to be in an incorrect location and either failing to operate to isolate a fault or misoperating to open a healthy transmission line.[59]

In addition to the challenges that have already been observed in the transmission system, preliminary research has identified several more challenges to emerge as the contribution of IBRs to the BPS increases further. Lately, there has been a long-term downward trend in estimates of system inertia.[60] There is speculation that replacing large synchronous generators with IBRs could continue the decline of system inertia and the rate of change of frequency (ROCOF) will rise. At a high enough ROCOF, system frequency may drop below a safe operating threshold before protection can operate to arrest the drop. This could lead to generator tripping, wide-scale load-shedding, or even blackouts.[61] Put another way, the critical operating time of circuit breakers before a grid instability occurs may be decreased. This timing must be monitored through protection studies as the state of the grid evolves to ensure the protection system is operating sufficiently fast.

Other studies have shown that changing generation from synchronous machines to IBRs changes the power swing dynamics of the bulk power system.[62] These changes in power swings may impact existing protection schemes, such as generator out-of-step protection or the power swing blocking elements of line protection. Furthermore, recent studies have indicated that poor or uncoordinated tuning of IBR controls can create oscillations or other dynamics that have a destabilizing effect on the grid and are currently not accounted for by transmission protection.

[59] SNL. Impact of Inverter-Based Resource Negative-Sequence Current Injection on Transmission System Protection. January, 2020. https://www.osti.gov/biblio/1595917
[60] NERC. State of Reliability 2017. June 2017. https://www.nerc.com/pa/RAPA/PA/Performance%20Analysis%20DL/SOR_2017_MASTER_20170613.pdf
[61] BNL. Frequency Control Requirements for Reliable Interconnection Frequency Response. February, 2018. https://emp.lbl.gov/publications/frequency-control-requirements
[62] IEEE. Protection Challenges and Practices for Interconnecting Inverter Based Resources to Utility Transmission Systems. July, 2020. https://resourcecenter.ieee-pes.org/publications/technical-reports/PES_TP_TR81_PSRC_WGC32_071520.html

Current State of the Art

Distribution Systems

The objectives and methods used in the protection of distribution systems, which are typically designed for radial flows of power, differs from those of transmission systems, which have meshed flows of power. Due to distribution feeders experiencing higher relative penetration rates of IBR sooner than the bulk transmission system, more research has been focused on the distribution level to investigate the impact of high penetrations of IBR on protection. Over the past years, this research has developed novel technologies and techniques to offer solutions and mitigations to challenges posed to distribution protection by IBR. Studies conducted by PNNL,[63,64] and other national labs,[65] have documented the technology gaps found in existing distribution protection and have proposed various state-of-the-art solutions. In most cases, the studies found that existing methods and commercially available devices can support protection for distribution systems with high penetration, up to 100% IBR. Where existing methods broke down, the studies suggest that adaptive settings or schemes can work in scenarios with highly variable conditions. The studies also found distance-based protection with incremental distance relays at PV sites improved performance metrics compared to traditional methods such as time-overcurrent protection. The studies additionally found that data-driven schemes showed promising results but require detailed models to perform electromagnetic transient (EMT) analysis and large volumes of data to train deep learning algorithms, such as convolutional neural networks (CNN), and that further field validation is needed.

Transmission Systems

More research into the impact of IBR on transmission protection is being performed as the penetration of renewable sources and IBR on transmission systems increases, especially in smaller islanded transmission systems that see very high IBR penetration rates. Some studies have shown that adjusting the settings of the existing deployed relays can provide an economic solution while

[63] PNNL. Protection of Distribution Circuits with High Penetration of Solar PV. October, 2021. https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-32230.pdf
[64] PNNL. Relaying for Distributed and Microgrids Evolving from Radial to Bidirectional Power Flow. September, 2019. https://www.osti.gov/biblio/1574999
[65] NREL. High-Penetration PV Integration Handbook for Distribution Engineers. January, 2016. https://www.nrel.gov/docs/fy16osti/63114.pdf

increasing dependability and security of power systems with IBRs.[66] Alternatively, improved performance has been shown to be achieved through slight modifications to existing protection algorithms, such as using different quantities for directional polarization. Multiple studies have reported that transmission line protection schemes may be improved in the presence of large amounts of non-dispatchable IBRs by using adaptive distance protection schemes.[67] Other researchers have proposed completely new fault detection algorithms, such as source-agnostic approaches,[68] or using new measurements, such as the voltage and current phasors from IBR-connected buses to set new boundaries for the relay settings.

Studies have also indicated that the use of communication-based protection, such as line differential schemes, may outperform distance protection in high-IBR scenarios. Not only can these schemes provide synchronized operation of multiple devices at different ends of a line, but they can also improve operating times. However, these approaches may not be economical due to the increased equipment requirements and may not cover all contingencies, such as how backup protection is achieved.[69] Alternative communication-based approaches have also been proposed, such as using phasor measurement units (PMUs) in line differential schemes.[70] PMUs have also been studied to estimate line impedance or system stability as inputs to protection functions.[71] However, studies have found the application of PMUs for protection are limited by synchrophasor signal quality, latency, and loss of GPS synchronization.

Simulation and Modeling

One challenge in studying and developing protection schemes in the presence of high IBR penetration has been that there is not yet a consistent approach to model the fault response of the various implementations of IBRs. The simulation tools used to perform protection studies need to be updated to consider a high

[66] IEEE, R. Chowdhury, N. Fischer, "Transmission Line Protection for Systems with Inverter-Based Resources – Part II: Solutions," October, 2020. https://ieeexplore.ieee.org/document/9233925
[67] IEEE, V. Telukunta, et. al., "Protection challenges under bulk penetration of renewable energy resources in power systems: A review," December, 2017. https://ieeexplore.ieee.org/document/8233582
[68] IEEE, P. Adhikari, et. al., "Source-Agnostic Time-Domain Distance Relay," December, 2021. https://ieeexplore.ieee.org/document/9640501
[69] IEEE, R. Chowdhury, N. Fischer, "Transmission Line Protection for Systems with Inverter-Based Resources – Part I: Problems," August, 2020. https://ieeexplore.ieee.org/document/9180079
[70] NASPI. WAMS in the Control Room – A TSO Perspective. October, 2021. https://www.naspi.org/sites/default/files/2021-10/2021_oct_naspi_wg_keynote_rubesa.pdf
[71] NASPI. Integrating Synchrophasor Technology into Power System Protection Applications. September, 2016. https://www.naspi.org/sites/default/files/reference_documents/naspi_2016_tr_007_power_system_protection_final.pdf

IBR penetration grid. There are various working groups developing recommendations and standards for modeling IBRs for protection studies.[72] However, more work is needed to validate the accuracy of the proposed models with real-world deployments, especially as grid forming IBRs come online. There has also been much effort recently to improve the capabilities of simulation platforms to study IBRs, especially in the area of co-simulation of transmission and distribution and IBR plants.[73] However, development of new protection schemes may also require updates to the software used to study protection, as some researchers have expressed struggles such as software not converging at 100% IBR penetration and not being able to perform EMT studies in large systems with many IBRs.

The integration of IBRs is changing the dynamic behavior of bulk power systems. Increasing the observability of transmission system dynamics is critical to monitor these changes and ensure safety and reliability. Currently, the technology and tools used to understand grid dynamics are not adequate under high IBR penetration scenarios. Particularly, grid fault signatures associated with different IBR penetration levels are not well understood and will require more high-fidelity monitoring. High resolution PMUs are mainly used for offline analysis or to inform the system's state but may also be useful in informing online protection systems. However, there are some examples of technical gaps for the adoption of high-resolution sensor data, including phasor and point-on-wave, to perform protection functions, such as:

- Utilization of high-resolution field data for model validation.
- Understanding grid fault signatures to develop new protection schemes.
- Investigation of fault signature changes as a function of IBR penetration level.
- Identifying protection system data requirements (e. g., sampling rates or cycles for actuation and operations, data buffer sizes, offline forensics analysis, latency, etc.).
- Lack of operational or system data to develop artificial intelligence or machine learning or hybrid protection schemes.
- Efficient data collection procedures from existing sensors, such as current and potential transformers, PMUs, fault data recorders (FDRs), power quality meters, online sensors, and correlation with existing relay measurements.

[72] IEEE, D. Ramasubramanian, et. al., "Simulation of 100% Inverter-Based Resource Grids with Positive Sequence Modeling," June, 2021. https://ieeexplore.ieee.org/document/9447546
[73] EPRI, "An Overview of Co-Simulation Platforms for Transmission Planning," December, 2019. https://www.epri.com/research/products/000000003002017494

- Communication requirements (e.g., infrastructure availability, network architecture, and latency).
- Analysis of the relation between protection tripping times and measurement precision.
- Ensuring data quality to minimize measurement errors and enable reliable analytics techniques.

Past Funding Efforts

SETO has invested resources to support research, development and demonstration of tools and technologies to understand and mitigate impacts and operational challenges related to the integration of solar systems technologies into the main power grid. These tools and technologies are crucial to ensure the stability, reliability and security of grid operations while transitioning to a decentralized grid with high IBR penetration. Previous funded efforts have focused on applications in distribution systems and microgrids targeting the following technical areas:

- Distribution planning and real-time operations[74] – technologies developed under this effort focused on enabling penetration levels between 50-100% distribution peak load. This included demonstration of new technologies that could address challenges such as bi-directional power flow, variable solar generation, interactions between transmission and distribution systems, and lack of visibility and control. Projects under this effort provided solutions to these challenges through the utilization of commercially available technologies and prototypes while demonstrating compatibility of the newly developed tools with existing grid infrastructure.
- Increased situational awareness of solar systems and storage on both distribution and transmission grids[75] –under this effort, projects were funded to advance technologies in areas such as dynamic modeling of utility-scale solar plants, control and coordination strategies, real-time system monitoring, robust communication structures, planning, and analytics. The new technologies developed under this funding aim to increase the cyber-physical resilience of the bulk power system, distribution grids, and microgrids to support critical infrastructure.

[74] SETO. Enabling Extreme Real-time Grid Integration of Solar Energy (ENERGISE). https://www.energy.gov/eere/solar/enabling-extreme-real-time-grid-integration-solar-energy-energise

[75] SETO. Advanced Systems Integration for Solar Technologies (ASSIST): Situational Awareness and Resilient Solutions for Critical Infrastructure. https://www.energy.gov/eere/solar/advanced-systems-integration-solar-technologies-assist-situational-awareness-and

- Improved protection in distribution systems[76] – technical advancements in this area were funded to develop technologies to improve protection, enhance visibility and control of PV inverters and plants, improve cybersecurity, and demonstrate benefits of distributed PV to supplement grid services. Projects under this effort focused on (1) improved models to inform system design to enable power systems engineers to plan, operate, and protect transmission and distribution systems, (2) autonomous protection systems using dynamic models to determine grid state, and (3) design of scalable adaptive protection platforms for distribution systems and microgrids.

Topic Objectives

With this topic area, SETO seeks to expand its portfolio to include projects that investigate the impact of high penetrations of IBR, including up to 100% penetration, on bulk power grid's transmission protection systems. The objectives of this topic are to further the industry's understanding of the transmission grid's behavior in response to faults in high-IBR scenarios and to develop technologies and system design strategies to maintain transmission grid reliability in high-IBR scenarios, such as new protection schemes, fault detection methods, or upgraded equipment and sensor deployments. The development and demonstration of new technologies that will generally improve reliability in high-IBR grids are strongly encouraged.

To this end, the highest scoring applications will include all of the following research focus areas:

1. Develop or improve upon methods and tools to better understand faults in high-IBR grids, such as improved simulation capabilities or validating modeling with field data.
2. Perform protection studies to identify any gaps in existing protection schemes to operate as expected in high-IBR grids, over various scenarios, including up to 100% IBR penetration.
3. Develop new protection schemes, control strategies, recommended modifications of IBR fault response, or propose updated configurations to existing protection schemes to address identified technical gaps in existing protection schemes.
4. Implement the strategies developed in hardware and demonstrate in a hardware-in-the-loop (HIL) laboratory or field environment.

[76] SETO. SETO FY2019 – Advanced Solar Systems Integration Technologies. https://www.energy.gov/eere/solar/seto-fy2019-advanced-solar-systems-integration-technologies

5. Develop a commercialization and implementation roadmap for the new study tools and protection strategies.

Projects should plan to include research tasks to develop enhancements to modeling and simulation capabilities to perform protection studies on large-scale, high-resolution transmission grids with large amounts of IBR. These simulations should have the ability to accurately represent the potential for device operation, equipment damage, destabilizing effects, or safety risks in scenarios where most of the generation is inverter-based, including up to all inverter-based generation. Successful applications will identify and address technical gaps in state-of-the-art simulation software used to analyze protection-related quantities in high-IBR grids. Simulation platforms improved in this project may be commercial software, software developed in other DOE projects, or novel applications, but applicants must clearly identify the improvements to be made through this funding. Software development may include methods to provide more automation in protection studies or device settings recommendations to address the challenge of updating protection schemes more often in a rapidly changing grid. Software developed or improved in this research focus area should provide quantities necessary to evaluate the effectiveness of existing protection schemes, as well as new protection schemes developed in this project, such as:

- short-circuit current response at various time scales (EMT, dynamic, steady state)
- destabilizing system dynamics
- time-varying system dynamics
- dangerous voltage or grounding conditions
- time coordination between transmission protection and inverter protection
- critical fault clearing time
- maintaining resource adequacy

Projects may also include a component to collect and analyze field data from existing sources, such as relays, PMUs, DFRs, or other line sensors, to help validate IBR modeling and simulation. If projects are able to collect large sets of field data, this research focus area may also include analysis to identify and classify protection issues that may inform future protection schemes, such as through artificial intelligence or machine learning based methods.

Projects should include research tasks to perform protection studies that identify potential technical gaps of existing protection schemes to not operate as expected in grids with high-IBR penetration. Studies should include various transitional levels of IBR penetration rates, up to 100%, and include scenarios where generation resources change dynamically from mostly synchronous to mostly IBR in short time frames, such as within hours. Studies should investigate

multiple protection schemes under various fault and generation scenarios. The transmission systems studied should include a significant number of both solar and wind generation plants. Studies should also consider the impact of IBR controls and protection, such as IBRs disconnecting during fault scenarios or potentially instabilities. Studies should consider IBR both at the utility-scale plant level and the aggregate impact of distributed resources at the distribution level.

Projects should include research tasks to develop new protection schemes, IBR controls, or other technologies to address the technical gaps identified in existing protection schemes. Proposed protection schemes may be in the form of updating existing protection equipment, such as developing relay settings or fault detection algorithms that respond better to IBR-based fault currents or adaptive schemes that strategically change settings, such as in response to changes in generation mix or system inertia. Proposed protection schemes may also be completely novel or yet-to-be-deployed methods or strategic deployments of existing advanced schemes, such as travelling-wave, line-differential, or other communication-based schemes. Alternatively, projects may propose updates to inverter controls that would allow existing protection schemes to continue to work securely under various IBR penetration rates. Proposed solutions may also be in the form of new fault current interrupting hardware technologies for faster fault-clearing in low-inertia grids. Projects may include analysis of how their solutions generally improve grid reliability and resilience, such as detecting high-impedance faults or downed conductors or investigating reclosing or preventative switching. However, projects must include analysis of how their proposed strategies improve the transmission grid's ability to maintain stability and security over existing approaches in high-IBR grids.

The proposed protection schemes, controls, and other new technology must be demonstrated in a HIL laboratory or in a field deployment, either with commercially available equipment or prototype hardware. Testing may be performed with simulated data sets representing transmission grid measurements, however, testing that uses real field-measured data is preferred. Projects that include the deployment of new, high-fidelity sensors to collect data that may further improve the industry's understanding of fault behavior in high-IBR grids are also strongly encouraged. Projects may also collect fault signatures through actual faulted equipment testing with IBRs in a laboratory or test site. Projects that include near-commercial field deployments of new protection systems that respond in real-time to measured quantities, but not necessarily operate switching equipment, will be given further consideration.

Projects should include a task to develop a roadmap for introducing their proposed protection schemes, controls, or new technologies into the transmission grid. The roadmap should specify the required upgrades to sensor deployments, communication networks, and other equipment. This roadmap should include a technoeconomic analysis of the work required for a potential deployment and analysis of how the solution would scale. Projects are encouraged to engage with standards development working groups or other industry stakeholder consortia as part of this research area. Projects that propose new sensors or upgrades to sensor deployments must specify the data requirements of their application, including but not limited to:

- Sampling and reporting rates
- Data quality assurances
- Cyber-physical security
- Interoperability with existing equipment (e.g., SCADA, relays, merging units, etc.)
- Communication network architecture
- Infrastructure upgrades
- Data sharing/storing security
- Gaps in communication protocols

Project Requirements

Well-defined metrics are necessary for SETO to assess the success of a project. Table 3 lists the features of interest to be included and addressed by prospective projects in this topic area. Proposals should provide quantifiable metrics that satisfy the capabilities listed. Values provided in the requirements column indicate a minimum desired value, but applicants are encouraged to develop their own ambitious performance metrics for each of these features.

Table 3. Description of project requirements under Topic 2.

Feature	Requirements
Protection Studies	- Time-domain simulations of the response of power system equipment, protection devices, and IBR controls to faults - Improved capability to study various generation mixes, up to, and including, 100% inverter-interfaced wind, solar, and battery sources - Identify methods to determine system stability throughout a fault considering both power system protection and IBR control logic
Study System Specifications	- Bulk power system with generation mix capable of supplying load capacity of > 400 MW - Based on a realistic section of the U.S. transmission system - Protection system must protect lines at transmission or sub-transmission voltage levels (above 35 kV)
Simulation Software Improvements	- Identify improvements to simulation software capabilities to perform protection studies in high-IBR grids, such as features added, % faster computation time, or greater efficiency (e.g., % improvement of overall workflow time of studies)
Applicability of Proposed Protection Schemes	- Identify scope of proposed protection scheme area of applicability, e.g., balanced or unbalanced faults, neutral connection, substation protection, HVDC
Fault Detection Speed of Proposed Protection Schemes	- Provide estimate of developed protection scheme's speed in detecting faults (e.g., less than 2 cycles)
Hardware Testing	- Demonstration of newly developed protection schemes in a laboratory or field setting with fault detection devices, such as commercial relays or new near-commercial prototypes
Sensing and Communication Requirements	- List of sensor and measurement type including data fidelity and resolution requirements - List of communication requirements of any proposed solutions, such as communication and data architectures, latency, data storage, etc. - List of data collection and analytics requirements, such as efforts to determine sampling rates/cycles for actuation and operations, data buffer sizes, offline forensics analysis, etc.
Data Availability	- Describe methods of making data collected or produced through this project secure and publicly available
Cybersecurity Assessment	- Describe potential cybersecurity risks associated with the proposed solution - Describe in detail whether proposed solutions will require additional cybersecurity measures for field deployment
Technoeconomic Analysis	- Plan for developing a commercialization and deployment roadmap - Additional equipment deployment (sensors, communications, controls) or system upgrade specifications and driving factors - Projected cost of technology rollout at various IBR generation levels
Team Partners	- At least one utility, regional transmission operator, or other entity responsible for establishing and operating transmission protection schemes - At least one equipment manufacturer, software vendor, or engineering firm that supplies transmission protection solutions - Teams are strongly encouraged to include community colleges, Tribal colleges, MSIs, or other institutes that do not typically engage in power systems research as project partners or to be engaged in project activities, in an effort to increase the diversity of people exposed to this field of study

Applications Not of Interest for Topic 2

- Applications that do not include the assessment of solar generation.
- Applications for which the majority of federal funding would be used for topics that are not the primary interest of this topic area, including:
  - Fault detection techniques that are not related to high penetration of IBRs.
  - Work that generally does not apply to the bulk power transmission grid, such as DC networks or microgrids.
  - Development of novel sensor hardware.
  - Methods or algorithms for data processing and analytics.
  - Incremental improvements or cost-reductions to existing commercial products, or seeking to demonstrate a singular product, device, or component.
  - Development of power electronics hardware.
  - Cybersecurity, including policy and network monitoring technologies for threat detection and mitigation.

All work under EERE funding agreements must be performed in the United States. See Section IV.J.iii. and Appendix C.

C. Additional Applications Specifically Not of Interest for Both Topic 1 and Topic 2

The following types of applications will be deemed nonresponsive and will not be reviewed or considered (See Section III.D. of the FOA):

- Applications that fall outside the technical parameters specified in Section I.A. and I.B. of the FOA.
- Applications for proposed technologies that are not based on sound scientific principles (e.g., violates the laws of thermodynamics).
- Applications that are described as not of interest in the topic area description in Section I.B. of the topic area to which they are applying.

D. Authorizing Statutes

The programmatic authorizing statutes are 42 U.S.C. 16238(b)(2) and 42 U.S.C. 16237(b)(2), as referenced in the Infrastructure Investment and Jobs Act of 2021, Division D, Section 41007(c)(1), which states that the Secretary is authorized "to carry out activities under section 3004(b)(2) of the Energy Act of 2020 (42 U.S.C. 16238(b)(2)), $40,000,000 for the period of fiscal years 2022 through 2025" and under Section 41007(b)(1) "to carry out activities under section 3003(b)(2) of the

Energy Act of 2020 (42 U.S.C. 16237(b)(2)), $60,000,000 for the period of fiscal years 2022 through 2025."

Awards made under this announcement will fall under the purview of 2 Code of Federal Regulation (CFR) Part 200 as amended by 2 CFR Part 910.

E. Notice of Bipartisan Infrastructure Law-Specific Requirements

Be advised that special terms and conditions apply to projects funded by the BIL relating to:

- Reporting, tracking and segregation of incurred costs;
- Reporting on job creation and preservation;
- Publication of information on the Internet;
- Access to records by Inspectors General and the Government Accountability Office;
- Requiring all of the iron, steel, manufactured goods, and construction materials used in the infrastructure activities of applicable projects are produced in the United States;
- Ensuring laborers and mechanics employed by contractors or subcontractors on BIL-funded projects are paid wages equivalent to prevailing wages on similar projects in the area;
- Protecting whistleblowers and requiring prompt referral of evidence of a false claim to an appropriate inspector general; and
- Certification and Registration.

Recipients of funding appropriated by the BIL must comply with requirements of all applicable Federal, State, and local laws, regulations, DOE policy and guidance, and instructions in this FOA. Recipients must flow down the requirements to subrecipients to ensure the recipient's compliance with the requirements.

Be advised that BIL funds can be used in conjunction with other funding, as necessary to complete projects, but tracking and reporting must be separate to meet the reporting requirements of the BIL and related Office of Management and Budget (OMB) Guidance. Applicants for projects funded by sources other than the BIL should plan to keep separate records for BIL funds and to ensure those records comply with the requirements of the BIL.

II. Award Information

A. Award Overview

i. Estimated Funding

EERE expects to make a total of approximately $26,000,000 of federal funding available for new awards under this FOA, subject to the availability of appropriated funds. EERE anticipates making approximately 6 to 9 awards under this FOA. EERE may issue one, multiple, or no awards. Individual awards may vary between $2,250,000 and $5,600,000.

EERE may issue awards in one, multiple, or none of the following topic areas:

Topic Area Number	Topic Area Title	Anticipated Number of Awards	Anticipated Minimum Award Size for Any One Individual Award (Fed Share)	Anticipated Maximum Award Size for Any One Individual Award (Fed Share)	Approximate Total Federal Funding Available for All Awards	Anticipated Period of Performance (months)
1	Wind and Solar Grid Services Design, Implementation, and Demonstration	3-5	$3,000,000	$6,000,000	$17,000,000	36
2	Protection of Bulk Power Systems with High Contribution from Inverter-Based Resources	3-4	$2,000,000	$3,000,000	$9,000,000	36

EERE may establish more than one budget period for each award and fund only the initial budget period(s). Funding for all budget periods, including the initial budget period, is not guaranteed. Before the expiration of the initial budget period(s), EERE may perform a down-select among different recipients and provide additional funding only to a subset of recipients.

ii. Period of Performance

EERE anticipates making awards that will run for 36 months in length, comprised of one or more budget periods. Project continuation will be contingent upon several elements, including satisfactory performance and Go/No-Go decision review. For a complete list, see Section VI.B.xiii. At the Go/No-Go decision points, EERE will evaluate project performance, project schedule adherence, the extent milestone objectives are met, compliance with reporting requirements, and overall contribution to the program goals and objectives. As a result of this

evaluation, EERE may, at its discretion, authorize the following actions: (1) continue to fund the project, contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority; (2) recommend redirection of work under the project; (3) place a hold on federal funding for the project, pending further supporting data or funding; or (4) discontinue funding the project because of insufficient progress, change in strategic direction, or lack of funding.

iii. New Applications Only

EERE will accept only new applications under this FOA. EERE will not consider applications for renewals of existing EERE-funded awards through this FOA.

B. EERE Funding Agreements

Through cooperative agreements and other similar agreements, EERE provides financial and other support to projects that have the potential to realize the FOA objectives. EERE does not use such agreements to acquire property or services for the direct benefit or use of the United States government.

i. Cooperative Agreements

EERE generally uses cooperative agreements to provide financial and other support to prime recipients.

Through cooperative agreements, EERE provides financial or other support to accomplish a public purpose of support or stimulation authorized by federal statute. Under cooperative agreements, the government and prime recipients share responsibility for the direction of projects.

EERE has substantial involvement in all projects funded via cooperative agreement. See Section VI.B.ix of the FOA for more information on what substantial involvement may involve.

ii. Funding Agreements with Federally Funded Research and Development Center (FFRDCs)

In most cases, FFRDCs are funded independently of the remainder of the project team. The FFRDC then executes an agreement with any non-FFRDC project team members to arrange work structure, project execution, and any other matters. Regardless of these arrangements, the entity that applied as the prime recipient for the project will remain the prime recipient for the project.

III. Eligibility Information

To be considered for substantive evaluation, an applicant's submission must meet the criteria set forth below. If the application does not meet these eligibility requirements, it will be considered ineligible and removed from further evaluation.

A. Eligible Applicants

i. Domestic Entities

The proposed prime recipient and subrecipient(s) must be domestic entities. The following types of domestic entities are eligible to participate as a prime recipient or subrecipient of this FOA:

1. Institutions of higher education;
2. For-profit entities;
3. Non-profit entities; and
4. State and local governmental entities, and Tribal Nations.

To qualify as a domestic entity, the entity must be organized, chartered or incorporated (or otherwise formed) under the laws of a particular state or territory of the United States; have majority domestic ownership and control; and have a physical place of business in the United States.

DOE/NNSA FFRDCs are eligible to apply for funding as a prime recipient or subrecipient.

Non-DOE/NNSA FFRDCs are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient.

Federal agencies and instrumentalities (other than DOE) are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient.

Entities identified on a Department of Homeland Security, Binding Operational Directives as an entity publicly banned from doing business with the Unites States government are not eligible. See https://cyber.dhs.gov/directives/.

Nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995 are **not** eligible to apply for funding.

ii. Foreign Entities

In limited circumstances, EERE may approve a waiver to allow a foreign entity to participate as a prime recipient or subrecipient. A foreign entity may submit an Full Application to this FOA, but the Full Application must be accompanied by an explicit written waiver request. Likewise, if the applicant seeks to include a foreign entity as a subrecipient, the applicant must submit a separate explicit written waiver request in the Full Application for each proposed foreign subrecipient.

Appendix C lists the information that must be included in a foreign entity waiver request. The applicant does not have the right to appeal EERE's decision concerning a waiver request.

iii. Incorporated Consortia

Domestic incorporated consortia are eligible to participate as a prime recipient or subrecipient. For consortia incorporated (or otherwise formed) under the laws of a state or territory of the United States, please refer to "Domestic Entities" above. For consortia incorporated (or otherwise formed) in a foreign country, please refer to the requirements in "Foreign Entities" above.

Each consortium must have an internal governance structure and a written set of internal rules. Upon request, the consortium must provide a written description of its internal governance structure and its internal rules to the DOE Contracting Officer.

If the consortium includes foreign members, the applicant must submit a separate explicit written waiver request in the Full Application for each foreign member. See Appendix C.

iv. Unincorporated Consortia

Unincorporated Consortia must designate one member of the consortium to serve as the prime recipient/consortium representative. The prime recipient/consortium representative must qualify as a domestic entity.

Upon request, unincorporated consortia must provide the EERE Contracting Officer with a collaboration agreement, commonly referred to as the articles of collaboration, which sets out the rights and responsibilities of each consortium member. This agreement binds the individual consortium members together and should discuss, among other things, the consortium's:

- Management structure;
- Method of making payments to consortium members;

- Means of ensuring and overseeing members' efforts on the project;
- Provisions for members' cost sharing contributions; and
- Provisions for ownership and rights in intellectual property developed previously or under the agreement.

If the consortium includes foreign members, the applicant must submit a separate explicit written waiver request in the Full Application for each foreign member. See Appendix C.

B. Cost Sharing

Topic Area 1
The cost share must be at least 50% of the total allowable costs for demonstration projects (i.e., the sum of the government share, including FFRDC costs if applicable, and the recipient share of allowable costs equals the total allowable cost of the project) and must come from non-federal sources unless otherwise allowed by law. (See 2 CFR 200.306 and 2 CFR 910.130 for the applicable cost sharing requirements.)

Topic Area 2
The cost share must be at least 20% of the total allowable costs (i.e., the sum of the government share, including FFRDC costs if applicable, and the recipient share of allowable costs equals the total allowable cost of the project) for research and development projects and 50% of the total allowable costs for demonstration and commercial application projects and must come from non-federal sources unless otherwise allowed by law. (See 2 CFR 200.306 and 2 CFR 910.130 for the applicable cost sharing requirements.) Demonstration activities for this topic include installing and operating prototype or commercial hardware in field demonstration site or pilot site, such as a utility distribution feeder, solar generation facility, or campus microgrid. Installations may be permanent or temporary for the duration of the demonstration.

To assist applicants in calculating proper cost share amounts, EERE has included a cost share information sheet and sample cost share calculation as Appendices A and B to this FOA.

i. Legal Responsibility

Although the cost share requirement applies to the project as a whole, including work performed by members of the project team other than the prime recipient, the prime recipient is legally responsible for paying the entire cost share. If the funding agreement is terminated prior to the end of the project period, the

prime recipient is required to contribute at least the cost share percentage of total expenditures incurred through the date of termination.

The prime recipient is solely responsible for managing cost share contributions by the project team and enforcing cost share obligation assumed by project team members in subawards or related agreements.

ii. Cost Share Allocation

Each project team is free to determine how best to allocate the cost share requirement among the team members. The amount contributed by individual project team members may vary, as long as the cost share requirement for the project as a whole is met.

iii. Cost Share Types and Allowability

Every cost share contribution must be allowable under the applicable federal cost principles, as described in Section IV.J.i. of the FOA. In addition, cost share must be verifiable upon submission of the Full Application.

Project teams may provide cost share in the form of cash or in-kind contributions. Cost share may be provided by the prime recipient, subrecipients, or third parties (entities that do not have a role in performing the scope of work). Vendors/contractors may not provide cost share. Any partial donation of goods or services is considered a discount and is not allowable.

Cash contributions include, but are not limited to: personnel costs, fringe costs, supply and equipment costs, indirect costs and other direct costs.

In-kind contributions are those where a value of the contribution can be readily determined, verified and justified but where no actual cash is transacted in securing the good or service comprising the contribution. Allowable in-kind contributions include, but are not limited to the donation of space or use of equipment.

Project teams may use funding or property received from state or local governments to meet the cost share requirement, so long as the funding was not provided to the state or local government by the federal government.

The prime recipient **may not** use the following sources to meet its cost share obligations including, but not limited to:

- Revenues or royalties from the prospective operation of an activity beyond the project period;
- Proceeds from the prospective sale of an asset of an activity;
- Federal funding or property (e.g., federal grants, equipment owned by the federal government); or
- Expenditures that were reimbursed under a separate federal program.
- Costs of software licenses. Costs for the purchase of off-the-shelf software offered commercially to the general public will be considered on a case-by-case basis and only to the extent the cost is allocable to the award. Third party donation of off-the-shelf software will be considered on a case-by-case basis. Software licenses for software owned by prime or sub-recipients will not be considered allowable as cost share.

Project teams may not use the same cash or in-kind contributions to meet cost share requirements for more than one project or program.

Cost share contributions must be specified in the project budget, verifiable from the prime recipient's records, and necessary and reasonable for proper and efficient accomplishment of the project. As all sources of cost share are considered part of total project cost, the cost share dollars will be scrutinized under the same federal regulations as federal dollars to the project. Every cost share contribution must be reviewed and approved in advance by the Contracting Officer and incorporated into the project budget before the expenditures are incurred.

Applicants are encouraged to refer to 2 CFR 200.306 as amended by 2 CFR 910.130 for additional cost sharing requirements.

iv. Cost Share Contributions by FFRDCs

Because FFRDCs are funded by the federal government, costs incurred by FFRDCs generally may not be used to meet the cost share requirement. FFRDCs may contribute cost share only if the contributions are paid directly from the contractor's Management Fee or another non-federal source.

v. Cost Share Verification

Applicants are required to provide written assurance of their proposed cost share contributions in their Full Applications.

Upon selection for award negotiations, applicants are required to provide additional information and documentation regarding their cost share contributions. Please refer to Appendix A of the FOA.

vi. Cost Share Payment

EERE requires prime recipients to contribute the cost share amount incrementally over the life of the award. Specifically, the prime recipient's cost share for each billing period must always reflect the overall cost share ratio negotiated by the parties (i.e., the total amount of cost sharing on each invoice when considered cumulatively with previous invoices must reflect, at a minimum, the cost sharing percentage negotiated). As FFRDC funding will be provided directly to the FFRDC(s) by DOE, prime recipients will be required to provide project cost share at a percentage commensurate with the FFRDC costs, on a budget period basis, resulting in a higher interim invoicing cost share ratio than the total award ratio.

In limited circumstances, and where it is in the government's interest, the EERE Contracting Officer may approve a request by the prime recipient to meet its cost share requirements on a less frequent basis, such as monthly or quarterly. Regardless of the interval requested, the prime recipient must be up-to-date on cost share at each interval. Such requests must be sent to the Contracting Officer during award negotiations and include the following information: (1) a detailed justification for the request; (2) a proposed schedule of payments, including amounts and dates; (3) a written commitment to meet that schedule; and (4) such evidence as necessary to demonstrate that the prime recipient has complied with its cost share obligations to date. The Contracting Officer must approve all such requests before they go into effect.

C. Compliance Criteria

Concept Papers, Full Applications, and Replies to Reviewer Comments must meet all compliance criteria listed below or they will be considered noncompliant. EERE will not review or consider noncompliant submissions, including Concept Papers, Full Applications, and Replies to Reviewer Comments that were: submitted through means other than EERE Exchange; submitted after the applicable deadline; and/or submitted incomplete. EERE will not extend the submission deadline for applicants that fail to submit required information by the applicable deadline due to server/connection congestion.

i. *Concept Papers*

Concept Papers are deemed compliant if:

- The Concept Paper complies with the content and form requirements in Section IV.C. of the FOA; and

- The applicant successfully uploaded all required documents and clicked the "Submit" button in EERE Exchange by the deadline stated in this FOA.

ii. *Full Applications*
Full Applications are deemed compliant if:

- The applicant submitted a compliant Concept Paper;
- The Full Application complies with the content and form requirements in Section IV.D. of the FOA; and
- The applicant successfully uploaded all required documents and clicked the "Submit" button in EERE Exchange by the deadline stated in the FOA.

iii. *Replies to Reviewer Comments*
Replies to Reviewer Comments are deemed compliant if:

- The Reply to Reviewer Comments complies with the content and form requirements in Section IV.E. of the FOA; and
- The applicant successfully uploaded all required documents to EERE Exchange by the deadline stated in the FOA.

D. Responsiveness Criteria

All "Applications Specifically Not of Interest," as described in Section I.C. of the FOA, are deemed nonresponsive and are not reviewed or considered.

E. Other Eligibility Requirements

i. Requirements for DOE/National Nuclear Security Agency (NNSA) Federally Funded Research and Development Centers (FFRDC) Listed as the applicant

A DOE/NNSA FFRDC is eligible to apply for funding under this FOA if its cognizant Contracting Officer provides written authorization and this authorization is submitted with the application.

The following wording is acceptable for the authorization:

> Authorization is granted for the Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complementary to the missions of the laboratory, and will not adversely impact execution of the DOE assigned programs at the laboratory.

(end of acceptable authorization)

If a DOE/NNSA FFRDC is selected for award negotiation, the proposed work will be authorized under the DOE work authorization process and performed under the laboratory's Management and Operating (M&O) contract.

ii. Requirements for DOE/NNSA and non-DOE/NNSA Federally Funded Research and Development Centers Included as a Subrecipient

DOE/NNSA and non-DOE/NNSA FFRDCs may be proposed as a subrecipient on another entity's application subject to the following guidelines:

i. *Authorization for non-DOE/NNSA FFRDCs*
The federal agency sponsoring the FFRDC must authorize in writing the use of the FFRDC on the proposed project and this authorization must be submitted with the application. The use of a FFRDC must be consistent with its authority under its award.

ii. *Authorization for DOE/NNSA FFRDCs*
The cognizant Contracting Officer for the FFRDC must authorize in writing the use of the FFRDC on the proposed project and this authorization must be submitted with the application. The following wording is acceptable for this authorization:

Authorization is granted for the Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complementary to the missions of the laboratory, and will not adversely impact execution of the DOE assigned programs at the laboratory.

iii. *Value/Funding*
The value of and funding for the FFRDC portion of the work will not normally be included in the award to a successful applicant. Usually, DOE will fund a DOE/NNSA FFRDC contractor through the DOE field work proposal (WP) system and non-DOE/NNSA FFRDC through an interagency agreement with the sponsoring agency.

iv. *Cost Share*
Although the FFRDC portion of the work is usually excluded from the award to a successful applicant, the applicant's cost share requirement will be based on the total cost of the project, including the applicant's, the subrecipient's, and the FFRDC's portions of the project.

v. *Responsibility*
The prime recipient will be the responsible authority regarding the settlement and satisfaction of all contractual and administrative issues including, but not limited to disputes and claims arising out of any agreement between the prime recipient and the FFRDC contractor.

vi. Agreement Requirements for DOE/NNSA FFRDCs Participating as a Subrecipient
DOE/NNSA FFRDCs participating as a subrecipient on a project and funded directly through the DOE WP System must establish a Cooperative Research and Development Agreement[77] (CRADA) or, if the role of the DOE/NNSA FFRDC is limited to technical assistance and intellectual property is not anticipated to be generated from the DOE/NNSA FFRDC's work, a Technical Assistance Agreement (TAA), with at least the prime recipient before any project work begins.

The CRADA or TAA is used to ensure accountability for project work and provide the appropriate management of intellectual property (IP), e.g., data protection and background IP. The DOE/NNSA FFRDC (or lead DOE/NNSA FFRDC, if more than one FFRDC is involved) must provide a Joint Work Statement to the DOE COs with cognizance over the DOE funding program and DOE/NNSA FFRDC by the second quarter of the project start date. The CRADA or TAA must be executed by all parties by the third quarter of the project start date.

F. Limitation on Number of Concept Papers and Full Applications Eligible for Review

An entity may submit more than one Concept Paper and Full Application to this FOA, provided that each application describes a unique, scientifically distinct project and provided that an eligible Concept Paper was submitted for each Full Application.

[77] A cooperative research and development agreement is a contractual agreement between a national laboratory contractor and a private company or university to work together on research and development. For more information, see https://www.energy.gov/gc/downloads/doe-cooperative-research-and-development-agreements

G. Questions Regarding Eligibility

EERE will not make eligibility determinations for potential applicants prior to the date on which applications to this FOA must be submitted. The decision whether to submit an application in response to this FOA lies solely with the applicant.

IV. Application and Submission Information

A. Application Process

The application process will include two phases: a Concept Paper phase, and a Full Application phase. **Only applicants who have submitted an eligible Concept Paper will be eligible to submit a Full Application**.

At each phase, EERE performs an initial eligibility review of the applicant submissions to determine whether they meet the eligibility requirements of Section III. of the FOA. EERE will not review or consider submissions that do not meet the eligibility requirements of Section III. All submissions must conform to the following form and content requirements, including maximum page lengths (described below) and must be submitted via EERE Exchange at https://eere-Exchange.energy.gov, unless specifically stated otherwise. **EERE will not review or consider submissions submitted through means other than EERE Exchange, submissions submitted after the applicable deadline, or incomplete submissions**. EERE will not extend deadlines for applicants who fail to submit required information and documents due to server/connection congestion.

A **Control Number** will be issued when an applicant begins the EERE Exchange application process. This control number must be included with all application documents, as described below.

The Concept Paper, Full Application, and Reply to Reviewer Comments must conform to the following requirements:

- Each must be submitted in Adobe PDF format unless stated otherwise;
- Each must be written in English;
- All pages must be formatted to fit on 8.5 x 11 inch paper with margins not less than one inch on every side. Use Calibri typeface, a black font color, and a font size of 12 point or larger (except in figures or tables, which may be 10 point font). A symbol font may be used to insert Greek letters or special characters, but the font size requirement still applies. References must be included as footnotes or endnotes in a font size of 10

or larger. Footnotes and endnotes are counted toward the maximum page requirement;

- The Control Number must be prominently displayed on the upper right corner of the header of every page. Page numbers must be included in the footer of every page; and
- Each submission must not exceed the specified maximum page limit, including cover page, charts, graphs, maps, and photographs when printed using the formatting requirements set forth above and single spaced. If applicants exceed the maximum page lengths indicated below, EERE will review only the authorized number of pages and disregard any additional pages.

Applicants are responsible for meeting each submission deadline. **Applicants are strongly encouraged to submit their Concept Papers, Full Applications, and Replies to Reviewer Comments at least 48 hours in advance of the submission deadline**. Under normal conditions (i.e., at least 48 hours in advance of the submission deadline), applicants should allow at least 1 hour to submit a Concept Paper, Full Application, or Reply to Reviewer Comments. Once the Concept Paper, Full Application, or Reply to Reviewer Comments is submitted in EERE Exchange, applicants may revise or update that submission until the expiration of the applicable deadline. If changes are made to any of these documents, the applicant must resubmit the Concept Paper, Full Application, or Reply to Reviewer Comments before the applicable deadline.

EERE urges applicants to carefully review their Concept Papers, Full Applications, and Replies to Reviewer Comments to allow sufficient time for the submission of required information and documents. All Full Applications that pass the initial eligibility review will undergo comprehensive technical merit review according to the criteria identified in Section V.A.ii. of the FOA.

i. Additional Information on EERE Exchange

EERE Exchange is designed to enforce the deadlines specified in this FOA. The "Apply" and "Submit" buttons will automatically disable at the defined submission deadlines. Should applicants experience problems with EERE Exchange, the following information may be helpful.

Applicants that experience issues with submission PRIOR to the FOA deadline: In the event that an applicant experiences technical difficulties with a submission, the applicant should contact the EERE Exchange helpdesk for assistance (EERE-ExchangeSupport@hq.doe.gov). The EERE Exchange helpdesk and/or the EERE Exchange system administrators will assist applicants in resolving issues.

B. Application Forms

The application forms and instructions are available on EERE Exchange. To access these materials, go to https://eere-Exchange.energy.gov and select the appropriate funding opportunity number.

Note: The maximum file size that can be uploaded to the EERE Exchange website is 10MB. Files in excess of 10MB cannot be uploaded, and hence cannot be submitted for review. If a file exceeds 10MB but is still within the maximum page limit specified in the FOA, it must be broken into parts and denoted to that effect. For example:

TechnicalVolume_Part_1
TechnicalVolume_Part_2

C. Content and Form of the Concept Paper

To be eligible to submit a Full Application, applicants must submit a Concept Paper by the specified due date and time. Each Concept Paper must be limited to a single concept or technology.

The Concept Paper must conform to the following requirements:

Section	Page Limit	Description
Cover Page	1 page maximum	The cover page should include the project title, the specific announcement Topic Area being addressed (if applicable), both the technical and business points of contact, names of all team member organizations, and any statements regarding confidentiality.
Technology Description	4 pages maximum	Applicants are required to describe succinctly: • The proposed technology, including its basic operating principles and how it is unique and innovative; • The proposed technology's target level of performance (applicants should provide technical data or other support to show how the proposed target could be met); • The current state-of-the-art in the relevant field and application, including key shortcomings, limitations, and challenges; • How the proposed technology will overcome the shortcomings, limitations, and challenges in the relevant field and application; • The potential impact that the proposed project would have on the relevant field and application; • The key technical risks/issues associated with the proposed technology development plan, including potential physical climate impacts that could affect project performance and

		• The impact that EERE funding would have on the proposed project.
Addendum	1 page maximum	Applicants are required to describe succinctly the qualifications, experience, and capabilities of the proposed Project Team, including: • Whether the Principal Investigator (PI) and Project Team have the skill and expertise needed to successfully execute the project plan; • Whether the applicant has prior experience which demonstrates an ability to perform tasks of similar risk and complexity; • Whether the applicant has worked together with its teaming partners on prior projects or programs; and • Whether the applicant has adequate access to equipment and facilities necessary to accomplish the effort and/or clearly explain how it intends to obtain access to the necessary equipment and facilities. • Applicants may provide graphs, charts, or other data to supplement their Technology Description.

EERE makes an independent assessment of each Concept Paper based on the criteria in Section V.A.i. of the FOA. EERE will encourage a subset of applicants to submit Full Applications. Other applicants will be discouraged from submitting a Full Application. An applicant who receives a "discouraged" notification may still submit a Full Application. EERE will review all eligible Full Applications. However, by discouraging the submission of a Full Application, EERE intends to convey its lack of programmatic interest in the proposed project in an effort to save the applicant the time and expense of preparing an application that is unlikely to be selected for award negotiations.

EERE may include general comments provided from reviewers on an applicant's Concept Paper in the encourage/discourage notification posted on EERE Exchange at the close of that phase.

D. Content and Form of the Full Application

Applicants must submit a Full Application by the specified due date and time to be considered for funding under this FOA. Applicants must complete the following application forms found on the EERE Exchange website at https://eere-Exchange.energy.gov/, in accordance with the instructions.

Applicants will have approximately 45 days from receipt of the Concept Paper Encourage/Discourage notification on EERE Exchange to prepare and submit a Full Application. Regardless of the date the applicant receives the

Encourage/Discourage notification, the submission deadline for the Full Application remains the date and time stated on the FOA cover page.

All Full Application documents must be marked with the Control Number issued to the applicant. Applicants will receive a control number upon clicking the "Create Concept Paper" button in EERE Exchange, and should include that control number in the file name of their Full Application submission (i.e., *Control number_Applicant Name_Full Application*).

i. Full Application Content Requirements

Each Full Application shall be limited to a single concept or technology. Full Applications must conform to the following requirements:

Component	File Format	Page Limit	File Name
Technical Volume	PDF	15	ControlNumber_LeadOrganization_TechnicalVolume
Resumes	PDF	2 pages each	ControlNumber_LeadOrganization_Resumes
Letters of Commitment	PDF	1 page each	ControlNumber_LeadOrganization_LOCs
Statement of Project Objectives	MS Word	10	ControlNumber_LeadOrganization_SOPO
SF-424	PDF	n/a	ControlNumber_LeadOrganization_App424
Budget Justification Workbook	MS Excel	n/a	ControlNumber_LeadOrganization_Budget_Justification
Summary/Abstract for Public Release	PDF	1	ControlNumber_LeadOrganization_Summary
Summary Slide	MS Powerpoint	1	ControlNumber_LeadOrganization_Slide
Subrecipient Budget Justification	MS Excel	n/a	ControlNumber_LeadOrganization_Subrecipient_Budget_Justification
DOE Work Proposal for FFRDC, if applicable (see DOE O 412.1A, Attachment 3)	PDF	n/a	ControlNumber_LeadOrganization_WP
Authorization from cognizant Contracting Officer for FFRDC	PDF	n/a	ControlNumber_LeadOrganization_FFRDCAuth
SF-LLL Disclosure of Lobbying Activities (prime applicant and subrecipients)	PDF	n/a	ControlNumber_LeadOrganization_SF-LLL
Buy America Requirements for Infrastructure Projects Waiver Requests	PDF	n/a	ControlNumber_LeadOrganization_BA_Waiver

Foreign Entity and Foreign Work Waivers	PDF	n/a	ControlNumber_LeadOrganization_Waiver
Community Benefits Plan: Job Quality and Equity	PDF	6	ControlNumber_LeadOrganization_CBenefits
Current and Pending Support	PDF	n/a	ControlNumber_LeadOrganization_CPS
Environmental Information Summary	PDF	n/a	ControlNumber_LeadOrganization_EQ

Note: The maximum file size that can be uploaded to the EERE Exchange website is 10MB. Files in excess of 10MB cannot be uploaded, and hence cannot be submitted for review. If a file exceeds 10MB but is still within the maximum page limit specified in the FOA it must be broken into parts and denoted to that effect. For example:

TechnicalVolume_Part_1
TechnicalVolume_Part_2

EERE will not accept late submissions that resulted from technical difficulties due to uploading files that exceed 10MB.

EERE provides detailed guidance on the content and form of each component below.

ii. Technical Volume

The Technical Volume must be submitted in PDF format. The Technical Volume must conform to the following content and form requirements, including maximum page lengths. If applicants exceed the maximum page lengths indicated below, EERE will review only the authorized number of pages and disregard any additional pages. This volume must address the Merit Review Criteria as discussed in Section V.A.ii. of the FOA. Save the Technical Volume in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_TechnicalVolume".

Applicants must provide sufficient citations and references to the primary research literature to justify the claims and approaches made in the Technical Volume. However, EERE and reviewers are under no obligation to review cited sources.

The Technical Volume to the Full Application may not be more than 15 pages, including the cover page, table of contents, and all citations, charts, graphs, maps, photos, or other graphics, and must include all of the information in the table below. The applicant should consider the weighting of each of the

evaluation criteria (see Section V.A.ii. of the FOA) when preparing the Technical Volume.

The Technical Volume should clearly describe and expand upon information provided in the Concept Paper. The Technical Volume must conform to the following content requirements:

SECTION/PAGE LIMIT	DESCRIPTION
Cover Page	The cover page should include the project title, the specific FOA Topic Area being addressed (if applicable), both the technical and business points of contact, names of all team member organizations, names of the senior/key personnel and their organizations, the project location(s), and any statements regarding confidentiality.
Project Overview (Approximately 10% of the Technical Volume)	The Project Overview should contain the following information: • Background: The applicant should discuss the background of their organization, including the history, successes, and current research and development status (i.e., the technical baseline) relevant to the technical topic being addressed in the Full Application. • Project Goal: The applicant should explicitly identify the targeted improvements to the baseline technology and the critical success factors in achieving that goal, including the ways in which the proposed project location and related infrastructure, workforce, etc. will contribute to the success of the overall project. • DOE Impact: The applicant should discuss the impact that DOE funding would have on the proposed project. Applicants should specifically explain how DOE funding, relative to prior, current, or anticipated funding from other public and private sources, is necessary to achieve the project objectives. • Community Benefits Plan: Job Quality and Equity – The applicant should summarize the overall anticipated benefits that will accrue to the local community and disadvantaged communities (including, but not limited to, the support of minority business enterprises). The applicant should summarize a plan to attract, train, and retain a skilled labor force with strong labor standards, ensure workers' free and fair chance to join a union, and identify potential partners they are working with to support these objectives. • The applicant should articulate a strategy for sharing and maximizing the project's benefits across disadvantaged communities and include a discussion of how resident and community leadership will be engaged throughout the project's duration. DOE encourages efforts to reach historically underserved populations and communities. These strategies should create the connectivity and conditions for growth where they may not exist, such as in rural, disadvantaged communities, and underserved communities. • Identify any potential long-term constraints project will have on community's access to natural resources (e.g., water) and Tribal cultural resources. Describe a long-term cleanup strategy that

	ensures communities and neighborhoods remain healthy and safe and not burden with cleanup costs and waste. • The applicant should outline a climate resilience strategy that accounts for climate impacts and extreme weather patterns such as high winds (tornadoes and hurricanes), heat and freezing temperatures, drought, wildfire, and floods.
Technical Description, Innovation, and Impact (Approximately 30% of the Technical Volume)	The Technical Description should contain the following information: • Relevance and Outcomes: The applicant should provide a detailed description of the technology, including the scientific and other principles and objectives that will be pursued during the project. This section should describe the relevance of the proposed project to the goals and objectives of the FOA, including the potential to meet specific DOE technical targets or other relevant performance targets. The applicant should clearly specify the expected outcomes of the project. • Feasibility: The applicant should demonstrate the technical feasibility of the proposed technology and capability of achieving the anticipated performance targets, including a description of previous work done and prior results. This section should also address how the project will secure and/or retain trained and qualified workers to meet the performance targets, as well as how the proposed project location and underlying infrastructure and workforce will contribute to the success of the overall project. • Innovation and Impacts: The applicant should describe the current state-of-the-art in the applicable field, the specific innovation of the proposed technology, the advantages of proposed technology over current and emerging technologies, and the overall impact on advancing the state-of-the-art/technical baseline if the project is successful.
Workplan and Market Transformation Plan (Approximately 40% of the Technical Volume)	The Workplan should include a summary of the Project Objectives, Technical Scope, Work Breakdown Structure (WBS), Milestones, Go/No-Go Decision Points, and Project Schedule. A detailed SOPO is separately requested. The Workplan should contain the following information: • Project Objectives: The applicant should provide a clear and concise (high-level) statement of the goals and objectives of the project as well as the expected outcomes. • Technical Scope Summary: The applicant should provide a summary description of the overall work scope and approach to achieve the objective(s). The overall work scope is to be divided by performance periods that are separated by discrete, approximately annual decision points (see below for more information on Go/No-Go decision points). The applicant should describe the specific

	expected end result of each performance period, including milestones detailed in the Community Benefits Plan. • WBS and Task Description Summary: The Workplan should describe the work to be accomplished and how the applicant will achieve the milestones, will accomplish the final project goal(s), and will produce all deliverables, including a strategy for securing qualified workers and reducing risk of work stoppages due to labor and/or community disputes. The Workplan is to be structured with a hierarchy of performance period (approximately annual), task and subtasks, which is typical of a standard WBS for any project. The Workplan shall contain a concise description of the specific activities to be conducted over the life of the project. The description shall be a full explanation and disclosure of the project being proposed (i.e., a statement such as "we will then complete a proprietary process" is unacceptable). It is the applicant's responsibility to prepare an adequately detailed task plan to describe the proposed project and the plan for addressing the objectives of this FOA. The summary provided should be consistent with the SOPO. The SOPO will contain a more detailed description of the WBS and tasks. • Milestone Summary: The applicant should provide a summary of appropriate milestones throughout the project to demonstrate success. A milestone may be either a progress measure (which can be activity based) or a SMART technical milestone. SMART milestones should be Specific, Measurable, Achievable, Relevant, and Timely, and must demonstrate a technical achievement rather than simply completing a task. Unless otherwise specified in the FOA, the minimum requirement is that each project must have at least one milestone per quarter for the duration of the project with at least one SMART technical milestone per year (depending on the project, more milestones may be necessary to comprehensively demonstrate progress). The applicant should also provide the means by which the milestone will be verified. The summary provided should be consistent with the Milestone Summary Table in the SOPO. • Go/No-Go Decision Points: The applicant should provide a summary of project-wide Go/No-Go decision points at appropriate points in the Workplan. A Go/No-Go decision point is a risk management tool and a project management best practice to ensure that, for the current phase or period of performance, technical success is definitively achieved and potential for success in future phases or periods of performance is evaluated, prior to actually beginning the execution of future phases. At a minimum, each project must have at least one project-wide Go/No-Go decision point for each budget period (12 to 18-month period) of the project. See Section VI.B.xiv. The applicant should also provide

	the specific technical criteria to be used to evaluate the project at the Go/No-Go decision point. The summary provided should be consistent with the SOPO. Go/No-Go decision points are considered "SMART" and can fulfill the requirement for an annual SMART milestone. • End of Project Goal: The applicant should provide a summary of the end of project goal(s). At a minimum, each project must have one SMART end of project goal. The summary provided should be consistent with the SOPO. • Project Schedule (Gantt Chart or similar): The applicant should provide a schedule for the entire project, including task and subtask durations, milestones, and Go/No-Go decision points. • Buy America Requirements for Infrastructure Projects: Within the first 2 pages of the Workplan, include a short statement on whether the project will involve the construction, alteration, and/or repair of infrastructure in the United States. See Appendix D for applicable definitions and other information to inform this statement. • Davis Bacon Act Requirements for Infrastructure Projects: Within the first 2 pages of the Workplan, include a short statement on whether the project will involve the construction, alteration, and/or repair of infrastructure in the United States. See Section K.viii for applicable definitions and other information to inform this statement. • Project Management: The applicant should discuss the team's proposed management plan, including the following: o The overall approach to and organization for managing the work o The roles of each project team member o Any critical handoffs/interdependencies among project team members o The technical and management aspects of the management plan, including systems and practices, such as financial and project management practices o The approach to project risk management, including labor disputes o A description of how project changes will be handled o If applicable, the approach to Quality Assurance/Control o How communications will be maintained among project team members

	○ How community engagement will be managed over the life of the project • Market Transformation Plan: The applicant should provide a market transformation plan, including the following: ○ Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including a mitigation plan ○ Identification of a product development and/or service plan, commercialization timeline, workforce development, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, and product distribution.
Technical Qualifications and Resources (Approximately 20% of the Technical Volume)	The Technical Qualifications and Resources should contain the following information: • Describe the project team's unique qualifications and expertise, including those of key subrecipients. • Describe required skill certifications and credentials for construction or production workforce. • Describe the project team's existing equipment and facilities that will facilitate the successful completion of the proposed project; include a justification of any new equipment or facilities requested as part of the project. • This section should also include relevant, previous work efforts, demonstrated innovations, and how these enable the applicant to achieve the project objectives. • Describe the time commitment of the key team members to support the project. • Describe the technical services to be provided by DOE/NNSA FFRDCs, if applicable. • For multi-organizational or multi-investigator projects, describe succinctly: ○ The roles and the work to be performed by each PI and senior/key personnel; ○ Business agreements between the applicant and each PI and senior/key personnel; ○ Relationships with relevant labor unions;

	○ Type of employment relationship with construction or production workforce, i.e., direct hires, contracted workers, temporary workers, etc.; ○ How the various efforts will be integrated and managed; ○ Process for making decisions on scientific/technical direction; ○ Publication arrangements; ○ Intellectual Property issues; and ○ Communication plans

iii. Resumes

A resume provides information that can be used by reviewers to evaluate the individual's skills, experience, and potential for leadership within the scientific community. Applicants are required to submit two-page resumes for the Principal Investigator and all Senior/Key Personnel that include the following:

1. Contact Information;
2. Education and training: Provide institution, major/area, degree, and year for undergraduate, graduate, and postdoctoral training including a certification or graduate credential for a Registered Apprenticeship or Labor Management Partnership;
3. Research and Professional Experience: Beginning with the current position, list professional/academic positions in chronological order with a brief description. List all current academic, professional, or institutional appointments, foreign or domestic, at the applicant institution or elsewhere, whether or not remuneration is received, and, whether full-time, part-time, or voluntary;
4. Awards and honors;
5. A list of up to 10 publications most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website address if available electronically. Patents, copyrights, and software systems developed may be provided in addition to or substituted for publications. An abbreviated style such as the Physical Review Letters (PRL) convention for citations (list only the first author) may be used for publications with more than 10 authors; and
6. Synergistic Activities: List up to five professional and scholarly activities related to the proposed effort.

Save the resumes in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Resumes".

In future FOAs, EERE may require a biographical sketch for the PI and senior/key personnel. In the meantime, in lieu of a resume, it is acceptable to use the biographical sketch format approved by the National Science Foundation (NSF). The biographical sketch format may be generated by the Science Experts Network Curriculum Vita (SciENcv), a cooperative venture maintained at https://www.ncbi.nlm.nih.gov/sciencv/, and is also available at https://nsf.gov/bfa/dias/policy/nsfapprovedformats/biosketch.pdf. The use of a format required by another agency is intended to reduce the administrative burden to researchers by promoting the use of common formats.

iv. Letters of Commitment

Submit letters of commitment from all subrecipient and third party cost share providers. If applicable, also include any letters of commitment from partners/end users (one-page maximum per letter) suppliers/partners/end users/future customers/labor unions/community-based organizations. Save the letters of commitment in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_LOCs".

v. Statement of Project Objectives (SOPO)

Applicants are required to complete a SOPO. A SOPO template is available on EERE Exchange at https://eere-Exchange.energy.gov/. The SOPO, including the Milestone Table, must not exceed 10 pages when printed using standard 8.5 x 11 paper with 1" margins (top, bottom, left, and right) with font not smaller than 12 point (except in figures or tables, which may be 10 point font). Save the SOPO in a single Microsoft Word file using the following convention for the title "ControlNumber_LeadOrganization_SOPO".

vi. SF-424: Application for Federal Assistance

Complete all required fields in accordance with the instructions on the form. The list of certifications and assurances in Field 21 can be found at http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms, under Certifications and Assurances. Note: The dates and dollar amounts on the SF-424 are for the complete project period and not just the first project year, first phase or other subset of the project period. Save the SF-424 in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_424".

vii. Budget Justification Workbook

Applicants are required to complete the Budget Justification Workbook. This form is available on EERE Exchange at https://eere-Exchange.energy.gov/. Prime recipients must complete each tab of the Budget Justification Workbook for the project as a whole, including all work to be performed by the prime recipient and its subrecipients and contractors. Applicants should include costs associated with required annual audits and incurred cost proposals in their proposed budget documents. Applicants should include costs associated with domestic procurement of materials and supplies and implementation of the good jobs plan. Any price proposal submitted shall clearly identify whether it is subject to such PLA requirements. The "Instructions and Summary" included with the Budget Justification Workbook will auto-populate as the applicant enters information into the Workbook. Applicants must carefully read the "Instructions and Summary" tab provided within the Budget Justification Workbook. Save the Budget Justification Workbook in a single Microsoft Excel file using the following convention for the title "ControlNumber_LeadOrganization_Budget_Justification".

viii. Summary/Abstract for Public Release

Applicants are required to submit a one-page summary/abstract of their project. The project summary/abstract must contain a summary of the proposed activity suitable for dissemination to the public. It should be a self-contained document that identifies the name of the applicant, the project director/principal investigator(s), the project title, the objectives of the project, a description of the project, including methods to be employed, the potential impact of the project (e.g., benefits, outcomes, including good jobs, equity, and economic development benefits), and major participants, including labor unions (for collaborative projects). This document must not include any proprietary or sensitive business information as DOE may make it available to the public after selections are made. The project summary must not exceed 1 page when printed using standard 8.5 x 11 paper with 1" margins (top, bottom, left, and right) with font not smaller than 12 point. Save the Summary for Public Release in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Summary".

ix. Summary Slide

Applicants are required to provide a single slide summarizing the proposed project. This slide is used during the evaluation process.

The Summary Slide template requires the following information:

- A technology summary;

- A description of the technology's impact;
- A description of the good jobs, equity, and economic development benefits;
- Proposed project goals;
- Any key graphics (illustrations, charts and/or tables);
- The project's key idea/takeaway;
- Project title, prime recipient, Principal Investigator, and senior/key personnel information; and
- Requested EERE funds and proposed applicant cost share.

Save the Summary Slide in a single Microsoft Powerpoint file using the following convention for the title "ControlNumber_LeadOrganization_Slide".

x. Subrecipient Budget Justification (if applicable)

Applicants must provide a separate budget justification for each subrecipient that is expected to perform work estimated to be more than $250,000 or 25 percent of the total work effort (whichever is less). The budget justification must include the same justification information described in the "Budget Justification" section above. Save each subrecipient budget justification in a Microsoft Excel file using the following convention for the title "ControlNumber_LeadOrganization_Subrecipient_Budget_Justification".

xi. Budget for DOE/NNSA FFRDC (if applicable)

If a DOE/NNSA FFRDC contractor is to perform a portion of the work, the applicant must provide a DOE WP in accordance with the requirements in DOE Order 412.1A, Work Authorization System, Attachment 3, available at: https://www.directives.doe.gov/directives-documents/400-series/0412.1-BOrder-a-chg1-AdmChg Save the WP in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_WP".

xii. Authorization for non-DOE/NNSA or DOE/NNSA FFRDCs (if applicable)

The federal agency sponsoring the FFRDC must authorize in writing the use of the FFRDC on the proposed project and this authorization must be submitted with the application. The use of a FFRDC must be consistent with the contractor's authority under its award. Save the Authorization in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_FFRDCAuth".

xiii. SF-LLL: Disclosure of Lobbying Activities (required)

Prime recipients and subrecipients may not use any federal funds to influence or attempt to influence, directly or indirectly, congressional action on any legislative or appropriation matters.

Prime recipients and subrecipients are required to complete and submit SF-LLL, "Disclosure of Lobbying Activities" (https://www.grants.gov/web/grants/forms/sf-424-individual-family.html) to ensure that non-federal funds have not been paid and will not be paid to any person for influencing or attempting to influence any of the following in connection with the application:

- An officer or employee of any federal agency;
- A Member of Congress;
- An officer or employee of Congress; or
- An employee of a Member of Congress.

Save the SF-LLL in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_SF-LLL".

xiv. Foreign Entity Participation

For projects selected under this FOA, as set forth in Section III, all prime recipients and subrecipients must be organized, chartered or incorporated (or otherwise formed) under the laws of a particular state or territory of the United States; have majority domestic ownership and control; and have a physical place of business in the United States. To request a waiver of this requirement, the applicant must submit an explicit waiver request in the Full Application. Appendix C lists the information that must be included in a waiver request.

xv. Foreign Work Waiver Request

As set forth in Section IV.J.iii., all work under EERE funding agreements must be performed in the United States. To request a waiver of this requirement, the applicant must submit an explicit waiver request in the Full Application. Appendix C lists the information that must be included in a foreign work waiver request.

Save the Waivers in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Waiver".

xvi. Waiver of the Build America, Buy America Requirement for Infrastructure Projects

As set forth in Section IV.K.vii., federally assisted projects which involve, undertaken by applicable recipient types, require that:

- all iron, steel, and manufactured products used in the infrastructure work are produced in the United States; and
- all construction materials used in the infrastructure work are manufactured in the United States.

In limited circumstances, DOE may grant a waiver of this requirement. Appendix D to this FOA provides guidance on how "infrastructure work" is defined, explains the applicable justifications under which a waiver may be granted, and lists the information that must be included in the waiver request.

Save the Waivers in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_BAWaiver".

xvii. Community Benefits Plan: Job Quality and Equity

The Community Benefits Plan: Job Quality and Equity (a.k.a. Community Benefits Plan or Plan) must set forth the applicant's framework to ensure that federal investments in the electric utility sector advance the following priorities: community and worker engagement; quality jobs; diversity, equity, inclusion, and accessibility (DEIA); and the Justice40 Initiative. The below sections set forth the Plan requirements in each of the foregoing areas.

The applicant's Community Benefits Plan must include at least one SMART (Specific, Measurable, Assignable, Realistic and Time-Related) milestone per budget period supported by metrics to measure the success of the proposed actions. The Community Benefits Plan will be evaluated as part of the technical review process. If the project is selected, DOE will incorporate the Community Benefits Plan into the award as part of the project requirements and the recipient will be required to meet the elements proposed in the plan. During the life of the DOE award, DOE will evaluate the recipient's progress, including as part of the Go/No-Go review process.

The Community Benefits Plan must be submitted in PDF format and must not exceed 6 pages, including all citations, charts, graphs, maps, photos, or other graphics. This Plan must address the technical review criterion titled, "Community Benefits Plan: Job Quality & Equity." See Section V of the FOA.

Save the Community Benefits Plan in a single PDF file using the following convention for the title "Control Number_LeadOrganization_CBenefits."

Community and Labor Engagement: The Community Benefits Plan must set forth the applicant's prior actions and future plans to engage with an inclusive collection of local stakeholders – such as, residents and businesses, entities that carry out workforce development programs, labor unions and worker organizations, local government, and community-based organizations that support or work with disadvantaged communities. For any engagement that occurred in developing the proposed project, applicants should provide letters of support from representative organizations reflecting substantive feedback on applicant's approach to community benefits including the quality jobs; diversity, equity, inclusion, and access; and Justice40 provisions detailed below.

In addition to describing any engagement that occurred in developing the proposed project, the Community Benefits Plan must describe how the applicant plans to incorporate community engagement before, during, and after the project. The goal of such engagement is to lay the groundwork for the negotiation of a Community Benefits Agreement[78], Good Neighbor Agreement, Community Workforce Agreement, or similar agreement documenting and formalizing commitments to the community related to topics of Quality Jobs; Diversity, Equity, Inclusions, and Access; and Justice40.

If selected for funding, applicants will furnish such agreements that identify how concerns will be mitigated, specify the distribution of community benefits, spell out roles and responsibilities, articulate reporting procedures, and identify remedies for non-compliance. By facilitating community input and social buy-in and strengthening accountability, such agreements substantially reduce or eliminate certain risks associated with project.

Quality Jobs: Good jobs are the key to attracting and retaining the qualified workforce required to meet program goals. The Community Benefits Plan must provide a framework for the creation and retention of good-paying quality jobs,[79] at safe and healthy worksites devoid of hostility and harassment, where workers are properly classified as employees, and have a free and fair chance to

[78] Community Benefit Agreement (CBA) Toolkit | Department of Energy

[79] A "quality job" is defined as a job that (1) exceeds the local prevailing wage for an industry in the region, includes basic benefits (e.g., paid leave, health insurance, retirement/savings plan), and/or is unionized, and (2) helps the employee develop the skills and experiences necessary to advance along a career path. See Economic Development Administration, ARPA Good Jobs Challenge NOFO, EDAHDQ-ARPGJ-2021-2006964, at n. 1, available at https://www.grants.gov/web/grants/viewopportunity.html?oppId=334720.

join a union.[80]The Plan is an opportunity for the applicant to detail their approach to supporting quality jobs. Successful applicants will be required to provide more detail and identify SMART milestones to ensure accountability with plan implementation. Letters of support may bolster, but not replace, the descriptions requested below.

Specific components of the Plan must include:

1) Describe the applicant's plan to attract, train, and retain a skilled and well qualified workforce for both (a) construction and (b) ongoing operations/production activities to **ensure project stability, continuity, and success**.
   a) For construction-phase jobs: Describe plans to utilize an appropriately licensed and credentialed skilled and trained workforce, including graduates of registered apprenticeship as well as workers currently enrolled in registered apprenticeship.
      i) When developing the Plan, the applicants should consider that for large construction projects (above $35M or possibly lower, on a case-by-case basis), DOE may require a Project Labor Agreement (PLA), an agreement between contractors and labor unions, as well as participation in Department of Labor's Mega-Construction Project program that provides technical assistance to promote work opportunities for disadvantaged workers. Assessment of applicability will be conducted on a case-by-case basis and in consultation with recipients to ensure project feasibility.
      NOTE: Project labor agreements are the preferred approach across construction projects of all sizes.

   b) For ongoing operations/production jobs:
      Describe the quality of jobs to be created and how these jobs will be sufficiently attractive to maintain a stable and skilled workforce.[81]
      Assurances include but are not limited to:
      i) Pay family-sustaining wages and provide clear opportunities for wage progression with skill progression or increased experience;
      ii) Provide health insurance and pension/retirement coverage options;

[80] Tactics used to keep workers from exercising their rights include: misclassification, pitting workers against each other, hiring union-busting consultants, intimidation and harassment, holding "captive audience" meetings, delays and exploitation of loopholes, and others.

[81] Successful applicants will be asked to submit detail on the minimum number of full-time operations-phase/production jobs and the associated job classifications, including anticipated minimum hourly wages and fringe benefits rates by worker classification.

iii) Provide work-family benefits, such as paid family and medical leave, paid sick leave, other paid time off, mental health supports; and
iv) Offer caregiving supports like flexible schedules, telework, child care facilitation, back-up child care.

c) For both construction and operations, describe commitment to support workforce education and training, which reduces employee turnover costs for employers, increases productivity from a committed and engaged workforce, and promotes a nimble, resilient, and stable workforce. Assurances include but are not limited to:
   i) Participate in labor-management training partnerships, including registered apprenticeship
   ii) Commit to employer contributions to training programs and paid time for employees to participate in skills training
   iii) Promote worker voice in training programs
   iv) Provide personalized, modularized, and flexible skill development opportunities, such as on-demand and self-directed virtual training
   v) Provide continuing education programs for employees to earn credentials and degrees relevant to their career pathways

2) Describe applicant's plan to support **workers' free and fair chance to join a union and exercise collective voice in the workplace**. Employees' ability to organize, bargain collectively, and participate through labor organizations of their choosing in decisions which affect them,[82] build meaningful economic power, safeguard the public interest, contribute to the effective conduct of business, and facilitate amicable settlements of disputes between employees and their employers, thus providing assurances of project efficiency, continuity, and multiple public benefits. Assurances include but are not limited to:
   a) Labor peace agreements[83]
   b) Commitment to card check neutrality agreements
   c) Support existing unions
   d) Pledge to permit voluntary recognition

[82] Federal Service Labor Management Relations Statute (5 U.S.C. 7101(a)(1))

[83] Ability to require labor peace agreements:
• By a governmental entity: Where a governmental entity receives DOE grant funds, whether directly as an Eligible Entity or as a subgrantee, and the governmental entity uses those funds for the construction of facilities over which it will maintain a proprietary interest (e.g., governmental ownership of the network), it is authorized and encouraged to require labor peace agreements, unless prohibited by state or local law.
• By a non-governmental subgrantee: Subgrantees that are non-governmental entities, and engage in construction or operations over which no governmental entity maintains a proprietary interest, are authorized and encouraged to require labor peace agreements, unless prohibited by state or local law

e) Commit to not requiring workers to sign noncompete clauses, arbitration agreements and/or class action waivers (unless required by a collective bargaining agreement)

3) Describe how the project will ensure the **highest standards of workplace safety and health**, including creating workplaces free from harassment and discrimination in order to support project continuity and success and employment that safeguards employee health and well-being. This should detail how employees will be involved in the development and execution of a workplace safety and health plan, including worksite analysis, hazard prevention and control, safety and health training, and anti-harassment training.

4) Describe the **job retention and/or transition** and other workforce development opportunities associated with the project noting efforts to create jobs.

DEIA: The Community Benefits Plan shall include a section describing how diversity, equity, inclusion, and accessibility (DEIA) objectives will be incorporated into the project. The section should detail how the applicant will partner with underrepresented businesses and project partners. The plan should include at least one SMART milestone per Budget Period supported by metrics to measure the success of the proposed actions and will be incorporated into the award if selected.

The following is a non-exhaustive list of potential DEIA actions that can serve as examples of ways the proposed project could incorporate DEIA elements. These examples should not be considered either comprehensive or prescriptive. Applicants may include appropriate actions not covered by these examples and should include a comprehensive set of specific DEIA actions anticipated in connection with the project.

a. Identify Minority Business Enterprises, Minority Owned Businesses, Woman Owned Businesses, and Veteran Owned Businesses to solicit as vendors and sub-contractors for bids on supplies, services and equipment;
b. Efforts to increase the representation of Minority Serving Institutions and as partners, as applicable;
c. Collaborate with researchers, and staff in Minority Serving Institutions, as applicable;
d. Identify workforce training partners to foster improved access to jobs for members of the community, including under-represented individuals and

those facing barriers to employment such as those with disabilities, returning citizens, opportunity youth, and veterans;

e. Anti-bias training and education to ensure hiring professionals can recognize unconscious bias and can learn how to reduce discriminatory barriers;
f. Support for quality apprenticeship readiness and/or pre-apprenticeship programs that are integrated with registered apprenticeship;
g. Comprehensive support services such as income supports, mental health supports, transportation assistance, and access to child care.) to improve access to career-track training and jobs for underrepresented and disadvantaged workers;
h. Describe Local and/or Economic Hire efforts (e.g., preferences for economically disadvantaged populations).

Justice40 Initiative Plan: Applicants are required to submit a Justice40 Initiative Plan, which should provide an overview of benefits that can be supported by measurable metrics and describe the benefits to disadvantaged communities. This section of the plan will be incorporated into the award and memorialized in a legally enforceable Community Benefits Agreement or similar document if selected, and shall include appropriate milestones for benefit delivery.

Specifically, the Justice40 Initiative Plan must include:

1. Identification of applicable disadvantaged communities to which the anticipated project benefits will flow.
2. Identification of applicable benefits that are quantifiable, measurable, and trackable.
    a. Benefits include (but are not limited to) measurable direct or indirect investments or positive project outcomes that achieve or contribute to the following in disadvantaged communities: (1) a decrease in energy burden; (2) a decrease in environmental exposure and burdens; (3) an increase in access to low-cost capital; (4) an increase in job creation, the clean energy job pipeline, and job training for individuals; (5) increases in clean energy enterprise creation and contracting (e.g., minority-owned or disadvantaged business enterprises); (6) increases in energy democracy, including community ownership; (7) increased parity in clean energy technology access and adoption; and (8) an increase in energy resilience.
3. A Discussion of Anticipated Negative and Cumulative Environmental Impacts on disadvantaged communities. For example, what are the anticipated environmental impacts associated with the project, and how will the applicant mitigate such impacts? Within the context of cumulative impacts

created by the project, the Applicant should use Environmental Protection Agency EJSCREEN tool to quantitatively discuss existing environmental impacts in the project area.

4. A Description of How Anticipated Benefits Are Expected to Flow to disadvantaged communities. For example, will the benefits be provided directly within the disadvantaged community(ies) identified in the Justice40 Initiative Plan, or are the benefits expected to flow in another way?

For projects funded under this FOA, DOE will provide specific reporting guidance for a subset of the eight policy priorities described above; however, recipients are also required to report how project benefits flow to applicable disadvantaged communities, in furtherance of the advancement of the policy priorities outlined above. For example, a recipient can describe how a project will increase access to clean energy and decrease harmful emissions in disadvantaged communities and provide methods for tracking the progress of these outcomes (See Section IV.D.xvii).

xviii. Current and Pending Support

Current and pending support is intended to allow the identification of potential duplication, overcommitment, potential conflicts of interest or commitment, and all other sources of support. As part of the application, the principal investigator and senior/key personnel at the applicant and subrecipient level must provide a list of all sponsored activities, awards, and appointments, whether paid or unpaid; provided as a gift with terms or conditions or provided as a gift without terms or conditions; full-time, part-time, or voluntary; faculty, visiting, adjunct, or honorary; cash or in-kind; foreign or domestic; governmental or private-sector; directly supporting the individual's research or indirectly supporting the individual by supporting students, research staff, space, equipment, or other research expenses. All foreign government-sponsored talent recruitment programs must be identified in current and pending support.

For every activity, list the following items:

- The sponsor of the activity or the source of funding
- The award or other identifying number
- The title of the award or activity. If the title of the award or activity is not descriptive, add a brief description of the research being performed that would identify any overlaps or synergies with the proposed research
- The total cost or value of the award or activity, including direct and indirect costs and cost share. For pending proposals, provide the total amount of requested funding
- The award period (start date – end date)

- The person-months of effort per year being dedicated to the award or activity

To identify overlap, duplication of effort, or synergistic efforts, append a description of the other award or activity to the current and pending support.

Details of any obligations, contractual or otherwise, to any program, entity, or organization sponsored by a foreign government must be provided on request to either the applicant institution or DOE. Supporting documents of any identified source of support must be provided to DOE on request, including certified translations of any document.

PIs and senior/key personnel must provide a separate disclosure statement listing the required information above regarding current and pending support. Each individual must sign and date their respective disclosure statement and include the following certification statement:

> I, [Full Name and Title], certify to the best of my knowledge and belief that the information contained in this Current and Pending Support Disclosure Statement is true, complete and accurate. I understand that any false, fictitious, or fraudulent information, misrepresentations, half-truths, or omissions of any material fact, may subject me to criminal, civil or administrative penalties for fraud, false statements, false claims or otherwise. (18 U.S.C. §§ 1001 and 287, and 31 U.S.C. 3729-3733 and 3801-3812). I further understand and agree that (1) the statements and representations made herein are material to DOE's funding decision, and (2) I have a responsibility to update the disclosures during the period of performance of the award should circumstances change which impact the responses provided above.

The information may be provided in the format approved by the National Science Foundation (NSF), which may be generated by the Science Experts Network Curriculum Vita (SciENcv), a cooperative venture maintained at https://www.ncbi.nlm.nih.gov/sciencv/, and is also available at https://www.nsf.gov/bfa/dias/policy/nsfapprovedformats/cps.pdf. The use of a format required by another agency is intended to reduce the administrative burden to researchers by promoting the use of common formats. If the NSF format is used, the individual must still include a signature, date, and a certification statement using the language included in the paragraph above.

Save the Current and Pending Support in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_CPS".

Definitions:

Current and pending support – (a) All resources made available, or expected to be made available, to an individual in support of the individual's RD&D efforts, regardless of (i) whether the source is foreign or domestic; (ii) whether the resource is made available through the entity applying for an award or directly to the individual; or (iii) whether the resource has monetary value; and (b) includes in-kind contributions requiring a commitment of time and directly supporting the individual's RD&D efforts, such as the provision of office or laboratory space, equipment, supplies, employees, or students. This term has the same meaning as the term Other Support as applied to researchers in NSPM-33: For researchers, Other Support includes all resources made available to a researcher in support of and/or related to all of their professional RD&D efforts, including resources provided directly to the individual or through the organization, and regardless of whether or not they have monetary value (e.g., even if the support received is only in-kind, such as office/laboratory space, equipment, supplies, or employees). This includes resource and/or financial support from all foreign and domestic entities, including but not limited to, gifts provided with terms or conditions, financial support for laboratory personnel, and participation of student and visiting researchers supported by other sources of funding.

Foreign Government-Sponsored Talent Recruitment Program – An effort directly or indirectly organized, managed, or funded by a foreign government, or a foreign government instrumentality or entity, to recruit science and technology professionals or students (regardless of citizenship or national origin, or whether having a full-time or part-time position). Some foreign government-sponsored talent recruitment programs operate with the intent to import or otherwise acquire from abroad, sometimes through illicit means, proprietary technology or software, unpublished data and methods, and intellectual property to further the military modernization goals and/or economic goals of a foreign government. Many, but not all, programs aim to incentivize the targeted individual to relocate physically to the foreign state for the above purpose. Some programs allow for or encourage continued employment at U.S. research facilities or receipt of federal research funds while concurrently working at and/or receiving compensation from a foreign institution, and some direct participants not to disclose their participation to U.S. entities. Compensation could take many forms including cash, research funding, complimentary foreign travel, honorific titles, career advancement opportunities, promised future

compensation, or other types of remuneration or consideration, including in-kind compensation.

Senior/key personnel – an individual who contributes in a substantive, meaningful way to the scientific development or execution of a research, development and demonstration (RD&D) project proposed to be carried out with DOE award.[84]

xix. Locations of Work

The applicant must complete the supplied template by listing the City, State, and zip code + 4 and State for each location where project work will be performed by the prime recipient or subrecipient(s). Save the completed template as a MS Excel file using the following convention for the title "Control Number_LeadOrganization_LOW."

xx. Environmental Questionnaire (EQ)

You must complete the Environmental Questionnaire. This form is available on EERE Exchange at https://eere-Exchange.energy.gov/. Save the Environmental Questionnaire in a single PDF file using the following convention for the title "Control Number_LeadOrganization_EQ."

E. Content and Form of Replies to Reviewer Comments

EERE will provide applicants with reviewer comments following the evaluation of all eligible Full Applications. Applicants have a brief opportunity to prepare a short Reply to Reviewer Comments (Reply). The Reply must not exceed three (3) pages. If a Reply is more than three (3) pages in length, EERE will review only the first three (3) pages and disregard any additional pages. Applicants may use the Reply to respond to one or more comments or to supplement their Full Application. The Reply may include text, graphs, charts, or data.

EERE will post the reviewer comments in EERE Exchange. The expected submission deadline is on the cover page of the FOA; however, it is the applicant's responsibility to monitor EERE Exchange in the event that the expected date changes. The deadline will not be extended for applicants who are unable to timely submit their Reply due to failure to check EERE Exchange or relying on the expected date alone. Applicants should anticipate having approximately three (3) business days to submit a Reply.

[84] Typically, these individuals have doctoral or other professional degrees, although individuals at the masters or baccalaureate level may be considered senior/key personnel if their involvement meets this definition. Consultants, graduate students, and those with a postdoctoral role also may be considered senior/key personnel if they meet this definition.

EERE will not review or consider ineligible Replies to Reviewer Comments (see Section III of the FOA). Applicants are not required to submit a Reply to Reviewer Comments. EERE will review and consider each eligible Full Application, even if no Reply is submitted or if the Reply is found to be ineligible.

F. Post Selection Information Requests

If selected for award, EERE reserves the right to request additional or clarifying information regarding the following (non-exhaustive list):

- Personnel proposed to work on the project and collaborating organizations (See Section VI.B.xviii. Participants and Collaborating Organizations);
- Current and Pending Support (See Sections IV.E.xvii and VI.B.xix. Current and Pending Support);
- A Data Management Plan (if applicable) describing how all research data displayed in publications resulting from the proposed work will be digitally accessible at the time of publications, in accordance with Section VI.B.xxii.;
- Indirect cost information;
- Other budget information;
- Commitment Letters from Third Parties Contributing to Cost Share, if applicable;
- Name and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (See 10 CFR 1040.5);
- Representation of Limited Rights Data and Restricted Software, if applicable;
- Information related to Davis-Bacon Act Requirements;
- Information related to Community Benefits Agreements, Good Neighbor Agreements, or other agreements applicants may have made with the relevant community
- Environmental Questionnaire; and
- Participants and Collaborating Organizations.

G. Unique Entity Identifier (UEI) and System for Award Management (SAM)

Each applicant (unless the applicant is an individual or federal awarding agency that is excepted from those requirements under 2 CFR 25.110(b) or (c), or has an exception approved by the federal awarding agency under 2 CFR 25.110(d)) is

required to: (1) Be registered in the SAM at https://www.sam.gov before submitting its application; (2) include the UEI in its application; and (3) continue to maintain an active SAM registration with current information at all times during which it has an active federal award or an application or plan under consideration by a federal awarding agency. DOE may not make a federal award to an applicant until the applicant has complied with all applicable UEI and SAM requirements and, if an applicant has not fully complied with the requirements by the time DOE is ready to make a federal award, the DOE will determine that the applicant is not qualified to receive a federal award and use that determination as a basis for making a federal award to another applicant.

H. Submission Dates and Times

All required submissions must be submitted in EERE Exchange no later than 5 p.m. Eastern Time on the dates provided on the cover page of this FOA.

I. Intergovernmental Review

This FOA is not subject to Executive Order 12372 – Intergovernmental Review of Federal Programs.

J. Funding Restrictions

i. Allowable Costs

All expenditures must be allowable, allocable, and reasonable in accordance with the applicable federal cost principles. Pursuant to 2 CFR 910.352, the cost principles in the Federal Acquisition Regulations (48 CFR Part 31.2) apply to for-profit entities. The cost principles contained in 2 CFR Part 200, Subpart E apply to all entities other than for-profits.

Costs to support or oppose union organizing, whether directly or as an offset for other funds, are unallowable.

ii. Pre-Award Costs

Selectees must request prior written approval to charge pre-award costs. Pre-award costs are those incurred prior to the effective date of the federal award directly pursuant to the negotiation and in anticipation of the federal award where such costs are necessary for efficient and timely performance of the scope of work. Such costs are allowable only to the extent that they would have been allowable if incurred after the date of the federal award and **only** with the written approval of the federal awarding agency, through the Contracting Officer assigned to the award.

Pre-award costs cannot be incurred prior to the Selection Official signing the Selection Statement and Analysis.

Pre-award expenditures are made at the selectee's risk. EERE is not obligated to reimburse costs: (1) in the absence of appropriations; (2) if an award is not made; or (3) if an award is made for a lesser amount than the selectee anticipated.

1. **National Environmental Policy Act (NEPA) Requirements Related to Pre-Award Costs**
   EERE's decision whether and how to distribute federal funds under this FOA is subject to NEPA. Applicants should carefully consider and should seek legal counsel or other expert advice before taking any action related to the proposed project that would have an adverse effect on the environment or limit the choice of reasonable alternatives prior to EERE completing the NEPA review process.

   EERE does not guarantee or assume any obligation to reimburse pre-award costs incurred prior to receiving written authorization from the Contracting Officer. If the applicant elects to undertake activities that DOE determines may have an adverse effect on the environment or limit the choice of reasonable alternatives prior to receiving such written authorization from the Contracting Officer, the applicant is doing so at risk of not receiving federal funding for their project and such costs may not be recognized as allowable cost share. Nothing contained in the pre-award cost reimbursement regulations or any pre-award costs approval letter from the Contracting Officer override these NEPA requirements to obtain the written authorization from the Contracting Officer prior to taking any action that may have an adverse effect on the environment or limit the choice of reasonable alternatives. Likewise, if an application is selected for negotiation of award, and the prime recipient elects to undertake activities that are not authorized for federal funding by the Contracting Officer in advance of EERE completing a NEPA review, the prime recipient is doing so at risk of not receiving federal funding and such costs may not be recognized as allowable cost share.

iii. Performance of Work in the United States (Foreign Work Waiver)

1. **Requirement**

All work performed under EERE awards must be performed in the United States. The prime recipient must flow down this requirement to its subrecipients.

2. **Failure to Comply**
   If the prime recipient fails to comply with the Performance of Work in the United States requirement, EERE may deny reimbursement for the work conducted outside the United States and such costs may not be recognized as allowable recipient cost share. The prime recipient is responsible should any work under this award be performed outside the United States, absent a waiver, regardless of whether the work is performed by the prime recipient, subrecipients, contractors or other project partners.

3. **Waiver**
   There may be limited circumstances where it is in the interest of the project to perform a portion of the work outside the United States. To seek a foreign work waiver, the applicant must submit a written waiver request to EERE. Appendix C lists the necessary information that must be included in a request for a foreign work waiver.

   The applicant must demonstrate to the satisfaction of EERE that a waiver would further the purposes of the FOA and is in the economic interests of the United States. EERE may require additional information before considering a waiver request. Save the waiver request(s) in a single PDF file. The applicant does not have the right to appeal EERE's decision concerning a waiver request.

iv. Construction

Recipients are required to obtain written authorization from the Contracting Officer before incurring any major construction costs.

v. Foreign Travel

If international travel is proposed for your project, please note that your organization must comply with the International Air Transportation Fair Competitive Practices Act of 1974 (49 USC 40118), commonly referred to as the "Fly America Act," and implementing regulations at 41 CFR 301-10.131 through 301-10.143. The law and regulations require air transport of people or property to, from, between, or within a country other than the United States, the cost of which is supported under this award, to be performed by or under a cost-sharing arrangement with a U.S. flag carrier, if service is available. Foreign travel costs

are allowable only with the written prior approval of the Contracting Officer assigned to the award.

vi. Equipment and Supplies

To the greatest extent practicable, all equipment and products purchased with funds made available under this FOA should be American-made. This requirement does not apply to used or leased equipment.

Property disposition will be required at the end of a project if the current fair market value of property exceeds $5,000. For-profit entity disposition requirements are set forth at 2 CFR 910.360. Property disposition requirements for other non-federal entities are set forth in 2 CFR 200.310 – 200.316.

vii. Buy America Requirements for Infrastructure Projects

Federally assisted projects which involve infrastructure work, undertaken by applicable recipient types, require that:

- all iron, steel, and manufactured products used in the infrastructure work are produced in the United States; and
- all construction materials used in the infrastructure work are manufactured in the United States.

Whether a given project must apply this requirement is project-specific and dependent on several factors, such as the recipient's entity type, whether the work involves "infrastructure," as that term is defined in Section 70914 of the Bipartisan Infrastructure Law, and whether the infrastructure in question is publicly owned or serves a public function.

Applicants are strongly encouraged to consult Appendix D of this FOA to determine whether their project may have to apply this requirement, both to make an early determination as to the need of a waiver, as well as to determine what impact, if any, this requirement may have on the proposed project's budget.

viii. Davis-Bacon Act Requirements

Projects awarded under this FOA will be funded under Division D of the Bipartisan Infrastructure Law. Accordingly, per section 41101 of that law, all laborers and mechanics employed by the applicant, subrecipients, contractors or subcontractors in the performance of construction, alteration, or repair work funded in whole or in part under this FOA shall be paid wages at rates not less than those prevailing on similar projects in the locality, as determined by the

Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code commonly referred to as the "Davis-Bacon Act" (DBA).

Applicants shall provide written assurance acknowledging the DBA requirements above, and confirming that the laborers and mechanics performing construction, alteration, or repair work on projects funded in whole or in part by awards made as a result of this FOA are paid or will be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by subchapter IV of Chapter 31 of Title 40, United States Code (Davis-Bacon Act).

Applicants acknowledge that they will comply with all of the Davis-Bacon Act requirements, including but not limited to:

(1) ensuring that the wage determination(s) and appropriate Davis-Bacon clauses and requirements are flowed down to and incorporated into any applicable subcontracts or subrecipient awards.

(2) ensuring that if wage determination(s) and appropriate Davis-Bacon clauses and requirements are improperly omitted from contracts and subrecipient awards, the applicable wage determination(s) and clauses are retroactively incorporated to the start of performance.

(3) being responsible for compliance by any subcontractor or subrecipient with the Davis-Bacon labor standards.

(4) receiving and reviewing certified weekly payrolls submitted by all subcontractors and subrecipients for accuracy and to identify potential compliance issues.

(5) maintaining original certified weekly payrolls for 3 years after the completion of the project and must make those payrolls available to the DOE or the Department of Labor upon request, as required by 29 CFR 5.6(a)(2).

(6) conducting payroll and job-site reviews for construction work, including interviews with employees, with such frequency as may be necessary to assure compliance by its subcontractors and subrecipients and as requested or directed by the DOE.

(7) cooperating with any authorized representative of the Department of Labor in their inspection of records, interviews with employees, and other actions undertaken as part of a Department of Labor investigation.

(8) posting in a prominent and accessible place the wage determination(s) and Department of Labor Publication: WH-1321, Notice to Employees Working on Federal or Federally Assisted Construction Projects.

(9) notifying the Contracting Officer of all labor standards issues, including all complaints regarding incorrect payment of prevailing wages and/or fringe benefits, received from the recipient, subrecipient, contractor, or subcontractor employees; significant labor standards violations, as defined in 29 CFR 5.7; disputes concerning labor standards pursuant to 29 CFR parts 4, 6, and 8 and as defined in FAR 52.222-14; disputed labor standards determinations; Department of Labor investigations; or legal or judicial proceedings related to the labor standards under this Contract, a subcontract, or subrecipient award.

(10) preparing and submitting to the Contracting Officer, the Office of Management and Budget Control Number 1910-5165, Davis Bacon Semi-Annual Labor Compliance Report, by April 21 and October 21 of each year. Form submittal will be administered through the iBenefits system (https://doeibenefits2.energy.gov) or its successor system.

Recipients of funding under this FOA will also be required to undergo Davis-Bacon Act compliance training and to maintain competency in Davis-Bacon Act compliance. The Contracting Officer will notify the recipient of any DOE sponsored Davis-Bacon Act compliance trainings. The U.S. Department of Labor ("DOL") offers free Prevailing Wage Seminars several times a year that meet this requirement, at https://www.dol.gov/agencies/whd/government-contracts/construction/seminars/events.

For additional guidance on how to comply with the Davis-Bacon provisions and clauses, see https://www.dol.gov/agencies/whd/government-contracts/construction and https://www.dol.gov/agencies/whd/government-contracts/protections-for-workers-in-construction .

ix. Lobbying

Recipients and subrecipients may not use any federal funds to influence or attempt to influence, directly or indirectly, congressional action on any legislative or appropriation matters.

Recipients and subrecipients are required to complete and submit SF-LLL, "Disclosure of Lobbying Activities" (https://www.grants.gov/web/grants/forms/sf-424-individual-family.html) to

ensure that non-federal funds have not been paid and will not be paid to any person for influencing or attempting to influence any of the following in connection with the application:

- An officer or employee of any federal agency;
- A Member of Congress;
- An officer or employee of Congress; or
- An employee of a Member of Congress.

x. Risk Assessment

Prior to making a federal award, the DOE is required by 31 U.S.C. 3321 and 41 U.S.C. 2313 to review information available through any Office of Management and Budget (OMB)-designated repositories of government-wide eligibility qualification or financial integrity information, such as SAM Exclusions and "Do Not Pay."

In addition, DOE evaluates the risk(s) posed by applicants before they receive federal awards. This evaluation may consider: results of the evaluation of the applicant's eligibility; the quality of the application; mitigation of labor and community disputes; financial stability; quality of management systems and ability to meet the management standards prescribed in this part; history of performance; reports and findings from audits; and the applicant's ability to effectively implement statutory, regulatory, or other requirements imposed on non-federal entities.

In addition to this review, DOE must comply with the guidelines on government-wide suspension and debarment in 2 CFR 180, and must require non-federal entities to comply with these provisions. These provisions restrict federal awards, subawards and contracts with certain parties that are debarred, suspended or otherwise excluded from or ineligible for participation in federal programs or activities.

xi. Invoice Review and Approval

DOE employs a risk-based approach to determine the level of supporting documentation required for approving invoice payments. Recipients may be required to provide some or all of the following items with their requests for reimbursement:

- Summary of costs by cost categories;
- Timesheets or personnel hours report;
- Proof of compliance with Davis-Bacon Act and electronic submittals of certified payroll reports if applicable;

- Disclosure of any citations related to NLRA, FLSA, OSH, SCA, or DBA, or Title VII;
- Invoices/receipts for all travel, equipment, supplies, contractual, and other costs;
- UCC filing proof for equipment acquired with project funds by for-profit recipients and subrecipients;
- Explanation of cost share for invoicing period;
- Analogous information for some subrecipients; and
- Other items as required by DOE.

xii. Prohibition related to Foreign Government-Sponsored Talent Recruitment Programs

a. Prohibition

Persons participating in a Foreign Government-Sponsored Talent Recruitment Program of a Foreign Country of Risk are prohibited from participating in projects selected for federal funding under this FOA. Should an award result from this FOA, the recipient must exercise continuing due diligence to reasonably ensure that no individuals participating on the DOE-funded project are participating in a Foreign Government-Sponsored Talent Recruitment Program of a Foreign Country of Risk. Consequences for violations of this prohibition will be determined according to applicable law, regulations, and policy. Further, the recipient must notify DOE within five (5) business days upon learning that an individual on the project team is or is believed to be participating in a foreign government talent recruitment program of a foreign country of risk. DOE may modify and add requirements related to this prohibition to the extent required by law.

b. Definitions

1. **Foreign Government-Sponsored Talent Recruitment Program.** An effort directly or indirectly organized, managed, or funded by a foreign government, or a foreign government instrumentality or entity, to recruit science and technology professionals or students (regardless of citizenship or national origin, or whether having a full-time or part-time position). Some foreign government-sponsored talent recruitment programs operate with the intent to import or otherwise acquire from abroad, sometimes through illicit means, proprietary technology or software, unpublished data and methods, and intellectual property to further the military modernization goals and/or economic goals of a foreign government. Many, but not all, programs aim to incentivize the targeted individual to relocate physically to the foreign state for the

above purpose. Some programs allow for or encourage continued employment at U.S. research facilities or receipt of Federal research funds while concurrently working at and/or receiving compensation from a foreign institution, and some direct participants not to disclose their participation to U.S. entities. Compensation could take many forms including cash, research funding, complimentary foreign travel, honorific titles, career advancement opportunities, promised future compensation, or other types of remuneration or consideration, including in-kind compensation.

2. **Foreign Country of Risk.** DOE has designated the following countries as foreign countries of risk: Iran, North Korea, Russia, and China. This list is subject to change.

xiii. Affirmative Action and Pay Transparency Requirements

All federally assisted construction contracts exceeding $10,000 annually will be subject to the requirements of Executive Order 11246:

(1) Recipients, subrecipients, contractors and subcontractors are prohibited from discriminating in employment decisions on the basis of race, color, religion, sex, sexual orientation, gender identity or national origin.

(2) Recipients and Contractors are required to take affirmative action to ensure that equal opportunity is provided in all aspects of their employment. This includes flowing down the appropriate language to all subrecipients, contractors and subcontractors.

(3) Recipients, subrecipients, contractors and subcontractors are prohibited from taking adverse employment actions against applicants and employees for asking about, discussing, or sharing information about their pay or, under certain circumstances, the pay of their co-workers.

The Department of Labor's (DOL) Office of Federal Contractor Compliance Programs (OFCCP) uses a neutral process to schedule contractors for compliance evaluations. OFCCP's Technical Assistance Guide[85] should be consulted to gain an understanding of the requirements and possible actions the recipients, subrecipients, contractors and subcontractors must take.

[85] See OFCCP's Technical Assistance Guide at: https://www.dol.gov/sites/dolgov/files/ofccp/Construction/files/ConstructionTAG.pdf?msclkid=9e397d68c4b111ec9d8e6fecb6c710ec Also see the National Policy Assurances http://www.nsf.gov/awards/managing/rtc.jsp

Additionally, for construction projects valued at $35 million or more and lasting more than one year, the recipients, subrecipients, contractors and subcontractors may be assigned by OFCCP as a mega construction project and may be neutrally selected for a compliance evaluation by OFCCP.[86]

V. Application Review Information

A. Technical Review Criteria

i. Concept Papers

Concept Papers are evaluated based on consideration the following factors. All sub-criteria are of equal weight.

Concept Paper Criterion: Overall FOA Responsiveness and Viability of the Project (Weight: 100%)
This criterion involves consideration of the following factors:

- The applicant clearly describes the proposed technology, describes how the technology is unique and innovative, and how the technology will advance the current state-of-the-art;
- The applicant has identified risks and challenges, including possible mitigation strategies, and has shown the impact that EERE funding and the proposed project would have on the relevant field and application;
- The applicant has the qualifications, experience, capabilities and other resources necessary to complete the proposed project; and
- The proposed work, if successfully accomplished, would clearly meet the objectives as stated in the FOA.

ii. Full Applications

Applications will be evaluated against the merit review criteria shown below. All sub-criteria are of equal weight.

Criterion 1: Technical Merit, Innovation, and Impact (45%)
This criterion involves consideration of the following factors:
Technical Merit and Innovation

- Extent to which the proposed technology or process is innovative;

[86] For more information regarding this program, see https://www.dol.gov/agencies/ofccp/construction/mega-program.

- Degree to which the current state of the technology and the proposed advancement are clearly described;
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state-of-the-art to the proposed advancement; and
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and revolutionary, including relevant data, calculations and discussion of prior work in the literature with analyses that support the viability of the proposed work.

Impact of Technology Advancement

- How the project supports the topic area objectives and target specifications and metrics; and
- The potential impact of the project on advancing the state-of-the-art.

Criterion 2: Project Research and Market Transformation Plan (25%)

This criterion involves consideration of the following factors:

Research Approach, Workplan and SOPO

- Degree to which the approach and critical path have been clearly described and thoughtfully considered; and
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed Workplan and SOPO will succeed in meeting the project goals.

Identification of Technical Risks

- Discussion and demonstrated understanding of the key technical risk areas involved in the proposed work and the quality of the mitigation strategies to address them.

Baseline, Metrics, and Deliverables

- The level of clarity in the definition of the baseline, metrics, and milestones; and
- Relative to a clearly defined experimental baseline, the strength of the quantifiable metrics, milestones, and a mid-point deliverables defined in the application, such that meaningful interim progress will be made.

Market Transformation Plan

- Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including mitigation plan; and
- Comprehensiveness of market transformation plan including but not limited to product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, and product distribution.

Criterion 3: Team and Resources (15%)
This criterion involves consideration of the following factors:

- The capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a high probability of success. The qualifications, relevant expertise, and time commitment of the individuals on the team;
- The sufficiency of the facilities to support the work;
- The degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further development and commercial deployment of the proposed technologies;
- The level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan; and
- The reasonableness of the budget and spend plan for the proposed project and objectives.

Criterion 4: Community Benefits Plan: Job Quality and Equity (Community Benefits Plan) (15%)
The extent to which applicant's Community Benefits Plan illustrates project viability and social risk mitigation through the delivery of high-quality jobs, minimal environmental impact, and allocation of 40% of project benefits to disadvantaged communities.

Community and Labor Engagement

- Extent to which project demonstrates a clear plan to engage local stakeholders, including labor unions and community-based organizations that support or work with disadvantaged communities.

Job Quality

- Quality and manner in which the proposed project will create or retain **high-paying, quality, safe jobs** and assurances of ability to attract, train, and retain skilled workers
- Extent to which applicant supports workers' free and fair choice to join a union and demonstrates partnership with labor and worker organizations.

Diversity, Equity, Inclusion, and Accessibility

- The quality and manner in which the proposed project incorporates DEIA goals and a commitment to accountability, as reflected in the Community Benefits Plan.

Justice40 Initiative

- Extent to which the project illustrates the ability to meet or exceed the objectives of the **Justice40 Initiative**, including the extent to which the project benefits disadvantaged or underserved communities and/or partners with Tribal Nations and commitment to accountability, as reflected in the Community Benefits Plan.

iii. Criteria for Replies to Reviewer Comments

EERE has not established separate criteria to evaluate Replies to Reviewer Comments. Instead, Replies to Reviewer Comments are attached to the original applications and evaluated as an extension of the Full Application.

B. Standards for Application Evaluation

Applications that are determined to be eligible will be evaluated in accordance with this FOA, by the standards set forth in EERE's Notice of Objective Merit Review Procedure (76 Fed. Reg. 17846, March 31, 2011) and the guidance provided in the "DOE Merit Review Guide for Financial Assistance," effective September 2020, which is available at: https://energy.gov/management/downloads/merit-review-guide-financial-assistance-and-unsolicited-proposals-current.

C. Other Selection Factors

i. Program Policy Factors

In addition to the above criteria, the Selection Official may consider the following program policy factors in determining which Full Applications to select for award negotiations:

- The proposed project exhibits technological diversity when compared to the existing DOE project portfolio and other projects selected from the subject FOA;
- The proposed project exhibits geographic, climate, and regional diversity when compared to the existing DOE project portfolio and other projects selected from the subject FOA;
- The proposed project supports demonstrations in economically distressed areas;
- The proposed project supports demonstrations that provide the greatest potential to reduce energy costs as well as promote accessibility and community implementation;

- The proposed project, including proposed cost share, optimizes the use of available EERE funding to achieve programmatic objectives;
- The proposed project exhibits an advanced level of industry involvement and demonstrated ability that will likely accelerate commercialization and overcome key market barriers;
- The proposed project is likely to lead to increased employment and manufacturing in the United States;
- The proposed project will accelerate transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty;
- The proposed project incorporates diversity, equity, and inclusion elements, including but not limited to team members from Minority Serving Institutions (e.g., Historically Black Colleges and Universities (HBCUs)/Other Minority Institutions), and team members that include Minority Business Enterprises, Minority Owned Businesses, Woman Owned Businesses, Veteran Owned Businesses, Tribal Nations, or members within disadvantaged communities;
- The proposed project maximizes benefits to disadvantaged communities; and
- The proposed project minimizes environmental impacts to disadvantaged communities.

Diversity (other than technological)

- The proposed project collectively represents diverse types and sizes of applicant organizations.

Optimize Funding

- The proposed project avoids duplication/overlap with other publicly or privately funded work.

Complementary Efforts

- The proposed project supports complementary efforts or projects, which, when taken together, will best achieve the research goals and objectives.

Market Impact

- The proposed project enables new and expanding market segments.

EE/Deployment

- The project's solution or strategy will maximize deployment or replication.

Tech Transfer

- The project promotes increased coordination with nongovernmental entities for demonstration of technologies and research applications to facilitate technology transfer.

D. Evaluation and Selection Process

i. Overview

The evaluation process consists of multiple phases; each includes an initial eligibility review and a thorough technical review. Rigorous technical reviews of eligible submissions are conducted by reviewers that are experts in the subject matter of the FOA. Ultimately, the Selection Official considers the recommendations of the reviewers, along with other considerations such as program policy factors, in determining which applications to select.

ii. Pre-Selection Interviews

As part of the evaluation and selection process, EERE may invite one or more applicants to participate in Pre-Selection Interviews. Pre-Selection Interviews are distinct from and more formal than pre-selection clarifications (See Section V.D.iii. of the FOA). The invited applicant(s) will meet with EERE representatives to provide clarification on the contents of the Full Applications and to provide EERE an opportunity to ask questions regarding the proposed project. The information provided by applicants to EERE through Pre-Selection Interviews contributes to EERE's selection decisions.

EERE will arrange to meet with the invited applicants in person at EERE's offices or a mutually agreed upon location. EERE may also arrange site visits at certain applicants' facilities. In the alternative, EERE may invite certain applicants to participate in a one-on-one conference with EERE via webinar, videoconference, or conference call.

EERE will not reimburse applicants for travel and other expenses relating to the Pre-Selection Interviews, nor will these costs be eligible for reimbursement as pre-award costs.

EERE may obtain additional information through Pre-Selection Interviews that will be used to make a final selection determination. EERE may select applications for funding and make awards without Pre-Selection Interviews. Participation in Pre-Selection Interviews with EERE does not signify that applicants have been selected for award negotiations.

iii. Pre-Selection Clarification

EERE may determine that pre-selection clarifications are necessary from one or more applicants. Pre-selection clarifications are distinct from and less formal than pre-selection interviews. These pre-selection clarifications will solely be for the purposes of clarifying the application, and will be limited to information already provided in the application documentation. The pre-selection clarifications may occur before, during or after the merit review evaluation process. Information provided by an applicant that is not necessary to address the pre-selection clarification question will not be reviewed or considered. Typically, a pre-selection clarification will be carried out through either written responses to EERE's written clarification questions or video or conference calls with EERE representatives.

The information provided by applicants to EERE through pre-selection clarifications is incorporated in their applications and contributes to the merit review evaluation and EERE's selection decisions. If EERE contacts an applicant for pre-selection clarification purposes, it does not signify that the applicant has been selected for negotiation of award or that the applicant is among the top ranked applications.

EERE will not reimburse applicants for expenses relating to the pre-selection clarifications, nor will these costs be eligible for reimbursement as pre-award costs.

iv. Recipient Integrity and Performance Matters

DOE, prior to making a federal award with a total amount of federal share greater than the simplified acquisition threshold, is required to review and consider any information about the applicant that is in the designated integrity and performance system accessible through SAM (currently FAPIIS) (see 41 U.S.C. 2313).

The applicant, at its option, may review information in the designated integrity and performance systems accessible through SAM and comment on any information about itself that a federal awarding agency previously entered and is currently in the designated integrity and performance system accessible through SAM.

DOE will consider any written comments by the applicant, in addition to the other information in the designated integrity and performance system, in making a judgment about the applicant's integrity, business ethics, and record of

performance under federal awards when completing the review of risk posed by applicants as described in 2 CFR 200.206.

v. Selection

The Selection Official may consider the technical merit, the Federal Consensus Board's recommendations, program policy factors, and the amount of funds available in arriving at selections for this FOA.

E. Anticipated Notice of Selection and Award Negotiation Dates

EERE anticipates notifying applicants selected for negotiation of award and negotiating awards by the dates provided on the cover page of this FOA.

VI. Award Administration Information

A. Award Notices

i. Ineligible Submissions

Ineligible Concept Papers and Full Applications will not be further reviewed or considered for award. The Contracting Officer will send a notification letter by email to the technical and administrative points of contact designated by the applicant in EERE Exchange. The notification letter will state the basis upon which the Concept Paper or the Full Application is ineligible and not considered for further review.

ii. Concept Paper Notifications

EERE will notify applicants of its determination to encourage or discourage the submission of a Full Application. EERE will post these notifications to EERE Exchange.

Applicants may submit a Full Application even if they receive a notification discouraging them from doing so. By discouraging the submission of a Full Application, EERE intends to convey its lack of programmatic interest in the proposed project. Such assessments do not necessarily reflect judgments on the merits of the proposed project. The purpose of the Concept Paper phase is to save applicants the considerable time and expense of preparing a Full Application that is unlikely to be selected for award negotiations.

A notification encouraging the submission of a Full Application does not authorize the applicant to commence performance of the project. Please refer to Section IV.J.ii. of the FOA for guidance on pre-award costs.

iii. Full Application Notifications

EERE will notify applicants of its determination via a notification letter by email to the technical and administrative points of contact designated by the applicant in EERE Exchange. The notification letter will inform the applicant whether or not its Full Application was selected for award negotiations. Alternatively, EERE may notify one or more applicants that a final selection determination on particular Full Applications will be made at a later date, subject to the availability of funds or other factors.

iv. Successful Applicants

Receipt of a notification letter selecting a Full Application for award negotiations does not authorize the applicant to commence performance of the project. If an application is selected for award negotiations, it is not a commitment by EERE to issue an award. Applicants do not receive an award until award negotiations are complete and the Contracting Officer executes the funding agreement, accessible by the prime recipient in FedConnect.

The award negotiation process will take approximately 60 days. Applicants must designate a primary and a backup point-of-contact in EERE Exchange with whom EERE will communicate to conduct award negotiations. The applicant must be responsive during award negotiations (i.e., provide requested documentation) and meet the negotiation deadlines. If the applicant fails to do so or if award negotiations are otherwise unsuccessful, EERE will cancel the award negotiations and rescind the Selection. EERE reserves the right to terminate award negotiations at any time for any reason.

Please refer to Section IV.J.ii. of the FOA for guidance on pre-award costs.

v. Alternate Selection Determinations

In some instances, an applicant may receive a notification that its application was not selected for award and EERE designated the application to be an alternate. As an alternate, EERE may consider the Full Application for federal funding in the future. A notification letter stating the Full Application is designated as an alternate does not authorize the applicant to commence performance of the project. EERE may ultimately determine to select or not select the Full Application for award negotiations.

vi. Unsuccessful Applicants

EERE shall promptly notify in writing each applicant whose application has not been selected for award or whose application cannot be funded because of the unavailability of appropriated funds.

B. Administrative and National Policy Requirements

i. Registration Requirements

There are several one-time actions before submitting an application in response to this FOA, and it is vital that applicants address these items as soon as possible. Some may take several weeks, and failure to complete them could interfere with an applicant's ability to apply to this FOA, or to meet the negotiation deadlines and receive an award if the application is selected. These requirements are as follows:

1. **EERE Exchange**
   Register and create an account on EERE Exchange at https://eere-Exchange.energy.gov. This account will then allow the user to register for any open EERE FOAs that are currently in EERE Exchange. It is recommended that each organization or business unit, whether acting as a team or a single entity, use only one account as the contact point for each submission. Applicants should also designate backup points of contact so they may be easily contacted if deemed necessary. **This step is required to apply to this FOA.** The EERE Exchange registration does not have a delay; however, **the remaining registration requirements below could take several weeks to process and are necessary for a potential applicant to receive an award under this FOA.**

2. **System for Award Management**
   Register with the SAM at https://www.sam.gov. Designating an Electronic Business Point of Contact (Ebiz POC) and obtaining a special password called a Marketing Partner ID Number (MPIN) are important steps in SAM registration. Please update your SAM registration annually.

3. **FedConnect**
   Register in FedConnect at https://www.fedconnect.net. To create an organization account, your organization's SAM MPIN is required. For more information about the SAM MPIN or other registration requirements, review the FedConnect Ready, Set, Go! Guide at https://www.fedconnect.net/FedConnect/Marketing/Documents/FedConnect_Ready_Set_Go.pdf.

4. **Grants.gov**
   Register in Grants.gov (http://www.grants.gov) to receive automatic updates when Amendments to this FOA are posted. However, please note that Concept Papers and Full Applications will not be accepted through Grants.gov.

5. **Electronic Authorization of Applications and Award Documents**
   Submission of an application and supplemental information under this FOA through electronic systems used by the DOE, including EERE Exchange and FedConnect.net, constitutes the authorized representative's approval and electronic signature.

ii. Award Administrative Requirements

The administrative requirements for DOE grants and cooperative agreements are contained in 2 CFR Part 200 as amended by 2 CFR Part 910.

iii. Foreign National Access

All applicants selected for an award under this FOA may be required to provide information to DOE in order to satisfy requirements for foreign nationals' access to DOE sites, information, technologies, equipment, programs or personnel. A foreign national is defined as any person who is not a U.S. citizen by birth or naturalization. If a selected applicant (including any of its subrecipients, contractors or vendors) anticipates involving foreign nationals in the performance of its award, the selected applicant may be required to provide DOE with specific information about each foreign national to ensure compliance with the requirements for access approval. National laboratory personnel already cleared for site access may be excluded.

iv. Subaward and Executive Reporting

Additional administrative requirements necessary for DOE grants and cooperative agreements to comply with the Federal Funding and Transparency Act of 2006 (FFATA) are contained in 2 CFR Part 170. Prime recipients must register with the new FFATA Subaward Reporting System database and report the required data on their first tier subrecipients. Prime recipients must report the executive compensation for their own executives as part of their registration profile in SAM.

v. National Policy Requirements

The National Policy Assurances that are incorporated as a term and condition of award are located at: http://www.nsf.gov/awards/managing/rtc.jsp.

vi. Environmental Review in Accordance with National Environmental Policy Act (NEPA)

EERE's decision whether and how to distribute federal funds under this FOA is subject to NEPA (42 U.S.C. 4321, *et seq.*). NEPA requires federal agencies to integrate environmental values into their decision-making processes by considering the potential environmental impacts of their proposed actions. For additional background on NEPA, please see DOE's NEPA website, at https://www.energy.gov/nepa.

While NEPA compliance is a federal agency responsibility and the ultimate decisions remain with the federal agency, all recipients selected for an award will be required to assist in the timely and effective completion of the NEPA process in the manner most pertinent to their proposed project. If DOE determines certain records must be prepared to complete the NEPA review process (e.g., biological evaluations or environmental assessments), the recipient may be required to prepare the records and the costs to prepare the necessary records may be included as part of the project costs.

vii. Flood Resilience

Applications should indicate whether the proposed project location(s) is within a floodplain, how the floodplain was defined, and how future flooding will factor into the project's design. The base floodplain long used for planning has been the 100-year floodplain, that is, a floodplain with a 1.0 percent chance of flooding in any given year. As directed by Executive Order 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input (2015), Federal agencies, including DOE, continue to avoid development in a floodplain to the extent possible. When doing so is not possible, Federal agencies are directed to "expand management from the current base flood level to a higher vertical elevation and corresponding horizontal floodplain to address current and future flood risk and ensure that projects funded with taxpayer dollars last as long as intended." The higher flood elevation is based on one of three approaches: climate-informed science (preferred), freeboard value, or 0.2 percent annual flood change (500-year floodplain). EO 13690 and related information is available at https://www.energy.gov/nepa/articles/eo-13690-establishing-federal-flood-risk-management-standard-and-process-further.

viii. Applicant Representations and Certifications

1. Lobbying Restrictions

By accepting funds under this award, the prime recipient agrees that none of the funds obligated on the award shall be expended, directly or indirectly, to influence Congressional action on any legislation or appropriation matters pending before Congress, other than to communicate to Members of Congress as described in 18 U.S.C. § 1913. This restriction is in addition to those prescribed elsewhere in statute and regulation.

2. **Corporate Felony Conviction and Federal Tax Liability Representations**
In submitting an application in response to this FOA, the applicant represents that:

   a. It is **not** a corporation that has been convicted of a felony criminal violation under any federal law within the preceding 24 months; and

   b. It is **not** a corporation that has any unpaid federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

   For purposes of these representations the following definitions apply:

   A Corporation includes any entity that has filed articles of incorporation in any of the 50 states, the District of Columbia, or the various territories of the United States [but not foreign corporations]. It includes both for-profit and non-profit organizations.

3. **Nondisclosure and Confidentiality Agreements Representations**
In submitting an application in response to this FOA the applicant represents that:

   a. It **does not and will not** require its employees or contractors to sign internal nondisclosure or confidentiality agreements or statements prohibiting or otherwise restricting its employees or contactors from lawfully reporting waste, fraud, or abuse to a designated investigative or law enforcement representative of a federal department or agency authorized to receive such information.

   b. It **does not and will not** use any federal funds to implement or enforce any nondisclosure and/or confidentiality policy, form, or agreement it uses unless it contains the following provisions:

(1) *''These provisions are consistent with and do not supersede, conflict with, or otherwise alter the employee obligations, rights, or liabilities created by existing statute or Executive order relating to (1) classified information, (2) communications to Congress, (3) the reporting to an Inspector General of a violation of any law, rule, or regulation, or mismanagement, a gross waste of funds, an abuse of authority, or a substantial and specific danger to public health or safety, or (4) any other whistleblower protection. The definitions, requirements, obligations, rights, sanctions, and liabilities created by controlling Executive orders and statutory provisions are incorporated into this agreement and are controlling.''*

(2) The limitation above shall not contravene requirements applicable to Standard Form 312 Classified Information Nondisclosure Agreement (https://fas.org/sgp/othergov/sf312.pdf), Form 4414 Sensitive Compartmented Information Disclosure Agreement (https://fas.org/sgp/othergov/intel/sf4414.pdf), or any other form issued by a federal department or agency governing the nondisclosure of classified information.

(3) Notwithstanding the provision listed in paragraph (a), a nondisclosure or confidentiality policy form or agreement that is to be executed by a person connected with the conduct of an intelligence or intelligence-related activity, other than an employee or officer of the United States government, may contain provisions appropriate to the particular activity for which such document is to be used. Such form or agreement shall, at a minimum, require that the person will not disclose any classified information received in the course of such activity unless specifically authorized to do so by the United States government. Such nondisclosure or confidentiality forms shall also make it clear that they do not bar disclosures to Congress, or to an authorized official of an executive agency or the Department of Justice, that are essential to reporting a substantial violation of law.

ix. Statement of Federal Stewardship

EERE will exercise normal federal stewardship in overseeing the project activities performed under EERE awards. Stewardship Activities include, but are not limited to, conducting site visits; reviewing performance and financial reports; providing assistance and/or temporary intervention in unusual circumstances to correct deficiencies that develop during the project; assuring compliance with

terms and conditions; and reviewing technical performance after project completion to ensure that the project objectives have been accomplished.

x. Statement of Substantial Involvement

EERE has substantial involvement in work performed under awards made as a result of this FOA. EERE does not limit its involvement to the administrative requirements of the award. Instead, EERE has substantial involvement in the direction and redirection of the technical aspects of the project as a whole. Substantial involvement includes, but is not limited to, the following:

1. EERE shares responsibility with the recipient for the management, control, direction, and performance of the project.

2. EERE may intervene in the conduct or performance of work under this award for programmatic reasons. Intervention includes the interruption or modification of the conduct or performance of project activities.

3. EERE may redirect or discontinue funding the project based on the outcome of EERE's evaluation of the project at the Go/No-Go decision point(s).

4. EERE participates in major project decision-making processes.

xi. Subject Invention Utilization Reporting

In order to ensure that prime recipients and subrecipients holding title to subject inventions are taking the appropriate steps to commercialize subject inventions, EERE may require that each prime recipient holding title to a subject invention submit annual reports for ten (10) years from the date the subject invention was disclosed to EERE on the utilization of the subject invention and efforts made by prime recipient or their licensees or assignees to stimulate such utilization. The reports must include information regarding the status of development, date of first commercial sale or use, gross royalties received by the prime recipient, and such other data and information as EERE may specify.

xii. Intellectual Property Provisions

The standard DOE financial assistance intellectual property provisions applicable to the various types of recipients are located at http://energy.gov/gc/standard-intellectual-property-ip-provisions-financial-assistance-awards.

xiii. Reporting

Potential reporting requirements are identified on the Federal Assistance Reporting Checklist, attached to the award agreement. This helpful EERE checklist can be accessed at https://www.energy.gov/eere/funding/eere-

funding-application-and-management-forms. See Attachment 2 Federal Assistance Reporting Checklist, after clicking on "Model Cooperative Agreement" under the Award Package section. The reporting requirements are subject to change.

Projects under this FOA will be funded, in whole or in part, with funds appropriated by the BIL. Be advised that additional reporting requirements may apply to projects funded by the BIL. As part of tracking progress toward key departmental goals – ensuring justice and equity, creating quality jobs, boosting domestic manufacturing, reducing greenhouse gas emissions, and advancing a pathway to private sector – DOE may require specific data collection. Examples of data that may be collected include:

- Community Benefits data, including:
    - Minority Business Enterprises, Minority Owned Businesses, Woman Owned Businesses and Veteran Owned Businesses acting as vendors and sub-contractors for bids on supplies, services and equipment.
    - Value, number, and type of partnerships with MSIs
    - Workforce and Community Agreement, including Community Benefits Agreement, Community Workforce Agreement, or Good Neighbor Agreements negotiated
    - Level and type of stakeholder engagement
- Funding leveraged, follow-on-funding, intellectual property generation and utilization

Data collection may be required at the start of a project, during a project's performance period, upon completion, and/or annually for a specified period after a completion. The reporting requirements will be specified in the DOE F 4600.2 or other related BIL guidance as they become available

xiv. Go/No-Go Review

Each project selected under this FOA will be subject to a periodic project evaluation referred to as a Go/No-Go Review. At the Go/No-Go decision points, EERE will evaluate project performance, project schedule adherence, meeting milestone objectives, compliance with reporting requirements, and overall contribution to the EERE program goals and objectives. Federal funding beyond the Go/No-Go decision point (continuation funding) is contingent upon (1) availability of federal funds appropriated by Congress for the purpose of this program; (2) the availability of future-year budget authority; (3) recipient's technical progress compared to the Milestone Summary Table stated in

Attachment 1 of the award; (4) recipient's submittal of required reports; (5) recipient's compliance with the terms and conditions of the award; (6) EERE's Go/No-Go decision; (7) the recipient's submission of a continuation application; and (8) written approval of the continuation application by the Contracting Officer.

As a result of the Go/No-Go Review, DOE may, at its discretion, authorize the following actions: (1) continue to fund the project, contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority; (2) recommend redirection of work under the project; (3) place a hold on federal funding for the project, pending further supporting data or funding; or (4) discontinue funding the project because of insufficient progress, change in strategic direction, or lack of funding.

The Go/No-Go decision is distinct from a non-compliance determination. In the event a recipient fails to comply with the requirements of an award, EERE may take appropriate action, including but not limited to, redirecting, suspending or terminating the award.

xv. Conference Spending

The recipient shall not expend any funds on a conference not directly and programmatically related to the purpose for which the grant or cooperative agreement was awarded that would defray the cost to the United States government of a conference held by any Executive branch department, agency, board, commission, or office for which the cost to the United States government would otherwise exceed $20,000, thereby circumventing the required notification by the head of any such Executive Branch department, agency, board, commission, or office to the Inspector General (or senior ethics official for any entity without an Inspector General), of the date, location, and number of employees attending such conference.

xvi. Uniform Commercial Code (UCC) Financing Statements

Per 2 CFR 910.360 (Real Property and Equipment) when a piece of equipment is purchased by a for-profit recipient or subrecipient with federal funds, and when the federal share of the financial assistance agreement is more than $1,000,000, the recipient or subrecipient must:

Properly record, and consent to the Department's ability to properly record if the recipient fails to do so, UCC financing statement(s) for all equipment in excess of $5,000 purchased with project funds. These financing statement(s) must be

approved in writing by the Contracting Officer prior to the recording, and they shall provide notice that the recipient's title to all equipment (not real property) purchased with federal funds under the financial assistance agreement is conditional pursuant to the terms of this section, and that the government retains an undivided reversionary interest in the equipment. The UCC financing statement(s) must be filed before the Contracting Officer may reimburse the recipient for the federal share of the equipment unless otherwise provided for in the relevant financial assistance agreement. The recipient shall further make any amendments to the financing statements or additional recordings, including appropriate continuation statements, as necessary or as the Contracting Officer may direct.

xvii. Implementation of Executive Order 13798, Promoting Free Speech and Religious Liberty

States, local governments, or other public entities may not condition sub-awards in a manner that would discriminate, or disadvantage sub-recipients based on their religious character.

xviii. Participants and Collaborating Organizations

If selected for award negotiations, the selected applicant must submit a list of personnel who are proposed to work on the project, both at the recipient and subrecipient level and a list of collaborating organizations within 30 days after the applicant is notified of the selection. Recipients will have an ongoing responsibility to notify DOE of changes to the personnel and collaborating organizations, and submit updated information during the life of the award.

xix. Current and Pending Support

If selected for award negotiations, within 30 days of the selection notice, the selectee must submit 1) current and pending support disclosures and resumes for any new PIs or senior/key personnel and 2) updated disclosures if there have been any changes to the current and pending support submitted with the application. Throughout the life of the award, the Recipient has an ongoing responsibility to submit 1) current and pending support disclosure statements and resumes for any new PI and senior/key personnel and 2) updated disclosures if there are changes to the current and pending support previously submitted to DOE. Also See. Section IV.E.xvii.

xx. U.S. Manufacturing Commitments

A primary objective of DOE's multi-billion dollar research, development, and demonstration investments is to cultivate new research and development ecosystems, manufacturing capabilities, and supply chains for and by U.S.

industry and labor. Therefore, in exchange for receiving taxpayer dollars to support an applicant's project, the applicant must agree to a U.S. Competitiveness provision requiring any products embodying any subject invention or produced through the use of any subject invention will be manufactured substantially in the United States unless the Recipient can show to the satisfaction of DOE that it is not commercially feasible. Award terms, including the specific U.S. Competitiveness Provision applicable to the various types of Recipients and projects, are available at https://www.energy.gov/gc/standard-intellectual-property-ip-provisions-financial-assistance-awards.

Please note that a subject invention is any invention conceived or first actually reduced to practice in performance of work under an award. An invention is any invention or discovery which is or may be patentable. The recipient includes any awardee, recipient, sub-awardee, or sub-recipient.

As noted in the U.S. Competitiveness Provision, at any time in which an entity cannot meet the requirements of the U.S. Competitiveness Provision, the entity may request a modification or waiver of the U.S. Competitiveness Provision. For example, the entity may propose modifying the language of the U.S. Competitiveness Provision in order to change the scope of the requirements or to provide more specifics on the application of the requirements for a particular technology. As another example, the entity may request that the U.S. Competitiveness Provision be waived in lieu of a net benefits statement or U.S. manufacturing plan. The statement or plan would contain specific and enforceable commitments that would be beneficial to the U.S. economy and competitiveness. Examples of such commitments could include manufacturing specific products in the U.S., making a specific investment in a new or existing U.S. manufacturing facility, keeping certain activities based in the U.S. or supporting a certain number of jobs in the U.S. related to the technology. If DOE, in its sole discretion, determines that the proposed modification or waiver promotes commercialization and provides substantial U.S. economic benefits, DOE may grant the request and, if granted, modify the award terms and conditions for the requesting entity accordingly.

More information and guidance on the waiver and modification request process can be found in the DOE Financial Assistance Letter on this topic, available at https://www.energy.gov/management/pf-2022-09-fal-2022-01-implementation-doe-determination-exceptional-circumstances-under. Additional information on DOE's Commitment to Domestic Manufacturing for DOE-funded R&D is available at https://www.energy.gov/gc/us-manufacturing.

The U.S. Competitiveness Provision is implemented by DOE pursuant to a Determination of Exceptional Circumstances (DEC) under the Bayh-Dole Act and DOE Patent Waivers. See Section VIII.J. Title to Subject Inventions of this FOA for more information on the DEC and DOE Patent Waivers.

xxi. Interim Conflict of Interest Policy for Financial Assistance Policy

The DOE interim Conflict of Interest Policy for Financial Assistance (COI Policy)[87] is applicable to all non-Federal entities applying for, or that receive, DOE funding by means of a financial assistance award (e.g., a grant, cooperative agreement, or technology investment agreement) and, through the implementation of this policy by the entity, to each Investigator who is planning to participate in, or is participating in, the project funded wholly or in part under the DOE financial assistance award. The term "Investigator" means the PI and any other person, regardless of title or position, who is responsible for the purpose, design, conduct, or reporting of a project funded by DOE or proposed for funding by DOE. Recipients must flow down the requirements of the interim COI Policy to any subrecipient non-Federal entities. Further, for EERE funded projects, the recipient must include all financial conflicts of interest (FCOI) (i.e., managed and unmanaged/ unmanageable) in their initial and ongoing FCOI reports.

It is understood that non-Federal entities and individuals receiving DOE financial assistance awards will need sufficient time to come into full compliance with DOE's interim COI Policy. To provide some flexibility, EERE allows for a staggered implementation. **Specifically, prior to award, applicants selected for award negotiations must: ensure all Investigators complete their significant financial disclosures; review the disclosures; determine whether a FCOI exists; develop and implement a management plan for FCOIs; and provide DOE with an initial FCOI report that includes all FCOIs (i.e., managed and unmanaged/ unmanageable).** Recipients will have 180 days from the date of the award to come into full compliance with the other requirements set forth in DOE's interim COI Policy. **Prior to award, the applicant must certify that it is, or will be within 180 days of the award, compliant with all requirements in the COI Policy.**

xxii. Fraud, Waste and Abuse

The mission of the DOE Office of Inspector General (OIG) is to strengthen the integrity, economy and efficiency of the Department's programs and operations including deterring and detecting fraud, waste, abuse and mismanagement. The OIG accomplishes this mission primarily through investigations, audits, and

[87] DOE's interim COI Policy can be found at PF 2022-17 FAL 2022-02 Department of Energy Interim Conflict of Interest Policy Requirements for Financial Assistance.

inspections of DOE activities to include grants, cooperative agreements, loans, and contracts.
The OIG maintains a Hotline for reporting allegations of fraud, waste, abuse, or mismanagement. To report such allegations, please visit https://www.energy.gov/ig/ig-hotline.

Additionally, recipients of DOE awards must be cognizant of the requirements of 2 CFR 200.113 Mandatory disclosures, which states:

> The non-Federal entity or applicant for a Federal award must disclose, in a timely manner, in writing to the Federal awarding agency or pass-through entity all violations of Federal criminal law involving fraud, bribery, or gratuity violations potentially affecting the Federal award. Non-Federal entities that have received a Federal award including the term and condition outlined in appendix XII of 2 CFR Part 200 are required to report certain civil, criminal, or administrative proceedings to SAM (currently FAPIIS). Failure to make required disclosures can result in any of the remedies described in 2 CFR 200.339. (See also 2 CFR part 180, 31 U.S.C. 3321, and 41 U.S.C. 2313.) [85 FR 49539, Aug. 13, 2020]

xxiii. Human Research Subjects

Research involving human subjects, biospecimens, or identifiable private information conducted with Department of Energy (DOE) funding is subject to the requirements of DOE Order 443.1C, Protection of Human Research Subjects, 45 CFR Part 46, Protection of Human Subjects (subpart A which is referred to as the "Common Rule"), and 10 CFR Part 745, Protection of Human Subjects.

Federal regulation and the DOE Order require review by an Institutional Review Board (IRB) of all proposed human subjects research projects. The IRB is an interdisciplinary ethics board responsible for ensuring that the proposed research is sound and justifies the use of human subjects or their data; the potential risks to human subjects have been minimized; participation is voluntary; and clear and accurate information about the study, the benefits and risks of participating, and how individuals' data/specimens will be protected/used, is provided to potential participants for their use in determining whether or not to participate.

The recipient shall provide the Federal Wide Assurance number identified in item 1) below and the certification identified in item 2) below to DOE prior to initiation of any project that will involve interactions with humans in some way (e.g., through surveys); analysis of their identifiable data (e.g., demographic data

and energy use over time); asking individuals to test devices, products, or materials developed through research; and/or testing of commercially available devices in buildings/homes in which humans will be present. Note: This list of examples is illustrative and not all inclusive.

No DOE funded research activity involving human subjects, biospecimens, or identifiable private information shall be conducted without:

1) A registration and a Federal Wide Assurance of compliance accepted by the Office of Human Research Protection (OHRP) in the Department of Health and Human Services; and
2) Certification that the research has been reviewed and approved by an Institutional Review Board (IRB) provided for in the assurance. IRB review may be accomplished by the awardee's institutional IRB; by the Central DOE IRB; or if collaborating with one of the DOE national laboratories, by the DOE national laboratory IRB.

The recipient is responsible for ensuring all subrecipients comply and for reporting information on the project annually to the DOE Human Subjects Research Database (HSRD) at https://science.osti.gov/HumanSubjects/Human-Subjects-Database/home. Note: If a DOE IRB is used, no end of year reporting will be needed.

Additional information on the DOE Human Subjects Research Program can be found at: HUMAN SUBJECTS Human Subjects Pr... | U.S. DOE Office of Science (SC) (osti.gov).

xxiv. Data Management Plan (DMP)

During the award negotiations phase, each applicant whose Full Application is selected for award negotiations will be required to finalize the DMP that was submitted as part of the application. A DMP explains how, when appropriate, data generated in the course of the work performed under an EERE award will be shared and preserved in order to validate the results of the proposed work or how the results could be validated if the data is not shared or preserved. The DMP must provide a plan for making all research data displayed in publications resulting from the proposed work digitally accessible at the time of publications.

VII. Questions/Agency Contacts

Upon the issuance of a FOA, EERE personnel are prohibited from communicating (in writing or otherwise) with applicants regarding the FOA except through the established question and answer process as described below. Specifically,

questions regarding the content of this FOA must be submitted to: SI.Grid-FOA.SETO@ee.doe.gov. Questions must be submitted not later than 3 business days prior to the application due date and time. Please note, feedback on individual concepts will not be provided through Q&A.

All questions and answers related to this FOA will be posted on EERE Exchange at: https://eere-exchange.energy.gov. **Please note that you must first select this specific FOA Number in order to view the questions and answers specific to this FOA**. EERE will attempt to respond to a question within 3 business days, unless a similar question and answer has already been posted on the website.

Questions related to the registration process and use of the EERE Exchange website should be submitted to: EERE-ExchangeSupport@hq.doe.gov.

VIII. Other Information

A. FOA Modifications

Amendments to this FOA will be posted on the EERE Exchange website and the Grants.gov system. However, you will only receive an email when an amendment or a FOA is posted on these sites if you register for email notifications for this FOA in Grants.gov. EERE recommends that you register as soon after the release of the FOA as possible to ensure you receive timely notice of any amendments or other FOAs.

B. Government Right to Reject or Negotiate

EERE reserves the right, without qualification, to reject any or all applications received in response to this FOA and to select any application, in whole or in part, as a basis for negotiation and/or award.

C. Commitment of Public Funds

The Contracting Officer is the only individual who can make awards or commit the government to the expenditure of public funds. A commitment by anyone other than the Contracting Officer, either express or implied, is invalid.

D. Treatment of Application Information

Applicants should not include trade secrets or commercial or financial information that is privileged or confidential in their application unless such information is necessary to convey an understanding of the proposed project or to comply with a requirement in the FOA. Applicants are advised to not include any critically sensitive proprietary detail.

If an application includes trade secrets or information that is commercial or financial, or information that is confidential or privileged, it is furnished to the Government in confidence with the understanding that the information shall be used or disclosed only for evaluation of the application. Such information will be withheld from public disclosure to the extent permitted by law, including the Freedom of Information Act. Without assuming any liability for inadvertent disclosure, EERE will seek to limit disclosure of such information to its employees and to outside reviewers when necessary for merit review of the application or as otherwise authorized by law. This restriction does not limit the Government's right to use the information if it is obtained from another source.

Full Applications, and other submissions containing confidential, proprietary, or privileged information must be marked as described below. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the Freedom of Information Act or otherwise. The U.S. Government is not liable for the disclosure or use of unmarked information, and may use or disclose such information for any purpose.

The cover sheet of the Full Application, and other submission must be marked as follows and identify the specific pages containing trade secrets, confidential, proprietary, or privileged information:

> **Notice of Restriction on Disclosure and Use of Data:**
> Pages [list applicable pages] of this document may contain trade secrets, confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for evaluation purposes or in accordance with a financial assistance or loan agreement between the submitter and the Government. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source. [End of Notice]

The header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: "Contains Trade Secrets, Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure." In addition, each line or paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting.

E. Evaluation and Administration by Non-Federal Personnel

In conducting the merit review evaluation, the Go/No-Go Reviews and Peer Reviews, the government may seek the advice of qualified non-federal personnel as reviewers. The government may also use non-federal personnel to conduct routine, nondiscretionary administrative activities, including EERE contractors. The applicant, by submitting its application, consents to the use of non-federal reviewers/administrators. Non-federal reviewers must sign conflict of interest (COI) and non-disclosure acknowledgements (NDA) prior to reviewing an application. Non-federal personnel conducting administrative activities must sign an NDA.

F. Notice Regarding Eligible/Ineligible Activities

Eligible activities under this FOA include those which describe and promote the understanding of scientific and technical aspects of specific energy technologies, but not those which encourage or support political activities such as the collection and dissemination of information related to potential, planned or pending legislation.

G. Notice of Right to Conduct a Review of Financial Capability

EERE reserves the right to conduct an independent third party review of financial capability for applicants that are selected for negotiation of award (including personal credit information of principal(s) of a small business if there is insufficient information to determine financial capability of the organization).

H. Requirement for Full and Complete Disclosure

Applicants are required to make a full and complete disclosure of all information requested. Any failure to make a full and complete disclosure of the requested information may result in:

- The termination of award negotiations;
- The modification, suspension, and/or termination of a funding agreement;
- The initiation of debarment proceedings, debarment, and/or a declaration of ineligibility for receipt of federal contracts, subcontracts, and financial assistance and benefits; and
- Civil and/or criminal penalties.

I. Retention of Submissions

EERE expects to retain copies of all Full Applications and other submissions. No submissions will be returned. By applying to EERE for funding, applicants consent to EERE's retention of their submissions.

J. Title to Subject Inventions

Ownership of subject inventions is governed pursuant to the authorities listed below:

- Domestic Small Businesses, Educational Institutions, and Nonprofits: Under the Bayh-Dole Act (35 U.S.C. § 200 et seq.), domestic small businesses, educational institutions, and nonprofits may elect to retain title to their subject inventions;
- All other parties: The federal Non-Nuclear Energy Act of 1974, 42. U.S.C. 5908, provides that the government obtains title to new inventions unless a waiver is granted (see below);
- Class Patent Waiver: DOE has issued a class waiver that applies to this FOA. Under this class waiver, domestic large businesses may elect title to their subject inventions similar to the right provided to the domestic small businesses, educational institutions, and nonprofits by law. In order to avail itself of the class waiver, a domestic large business must agree that any products embodying or produced through the use of a subject invention first created or reduced to practice under this program will be substantially manufactured in the United States.
- Advance and Identified Waivers: For an applicant not covered by a Class Patent Waiver or the Bayh-Dole Act, the applicant may request a patent waiver that will cover subject inventions that may be invented under the award, in advance of or within 30 days after the effective date of the award. Even if an advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver for identified inventions, i.e., individual subject inventions that are disclosed to EERE within the timeframes set forth in the award's intellectual property terms and conditions. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784.
- DEC: On June 07, 2021, DOE approved a DETERMINATION OF EXCEPTIONAL CIRCUMSTANCES (DEC) UNDER THE BAYH-DOLE ACT TO FURTHER PROMOTE DOMESTIC MANUFACTURE OF DOE SCIENCE AND ENERGY TECHNOLOGIES. In accordance with this DEC, all awards, including sub-awards, under this FOA shall include the U.S. Competitiveness Provision in accordance with the U.S. Manufacturing

Commitments section of this FOA. A copy of the DEC can be found at https://www.energy.gov/gc/determination-exceptional-circumstances-decs. Pursuant to 37 CFR § 401.4, any nonprofit organization or small business firm as defined by 35 U.S.C. 201 affected by any DEC has the right to appeal it by providing written notice to DOE within 30 working days from the time it receives a copy of the determination.

- DOE may issue and publish on the website above further DECs prior to the issuance of awards under this FOA. DOE may require additional submissions or requirements as authorized by any applicable DEC.

K. Government Rights in Subject Inventions

Where prime recipients and subrecipients retain title to subject inventions, the U.S. government retains certain rights.

i. Government Use License

The U.S. government retains a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States any subject invention throughout the world. This license extends to contractors doing work on behalf of the government.

ii. March-In Rights

The U.S. government retains march-in rights with respect to all subject inventions. Through "march-in rights," the government may require a prime recipient or subrecipient who has elected to retain title to a subject invention (or their assignees or exclusive licensees), to grant a license for use of the invention to a third party. In addition, the government may grant licenses for use of the subject invention when a prime recipient, subrecipient, or their assignees and exclusive licensees refuse to do so.

DOE may exercise its march-in rights only if it determines that such action is necessary under any of the four following conditions:

- The owner or licensee has not taken or is not expected to take effective steps to achieve practical application of the invention within a reasonable time;
- The owner or licensee has not taken action to alleviate health or safety needs in a reasonably satisfied manner;
- The owner has not met public use requirements specified by federal statutes in a reasonably satisfied manner; or
- The U.S. manufacturing requirement has not been met.

Any determination that march-in rights are warranted must follow a fact-finding process in which the recipient has certain rights to present evidence and witnesses, confront witnesses and appear with counsel and appeal any adverse decision. To date, DOE has never exercised its march-in rights to any subject inventions.

L. Rights in Technical Data

Data rights differ based on whether data is first produced under an award or instead was developed at private expense outside the award.

"Limited Rights Data": The U.S. government will not normally require delivery of confidential or trade secret-type technical data developed solely at private expense prior to issuance of an award, except as necessary to monitor technical progress and evaluate the potential of proposed technologies to reach specific technical and cost metrics.

Government Rights in Technical Data Produced Under Awards: The U.S. government normally retains unlimited rights in technical data produced under government financial assistance awards, including the right to distribute to the public. However, pursuant to special statutory authority, certain categories of data generated under EERE awards may be protected from public disclosure for up to five years after the data is generated ("Protected Data"). For awards permitting Protected Data, the protected data must be marked as set forth in the awards intellectual property terms and conditions and a listing of unlimited rights data (i.e., non-protected data) must be inserted into the data clause in the award. In addition, invention disclosures may be protected from public disclosure for a reasonable time in order to allow for filing a patent application.

M. Copyright

The prime recipient and subrecipients may assert copyright in copyrightable works, such as software, first produced under the award without EERE approval. When copyright is asserted, the government retains a paid-up nonexclusive, irrevocable worldwide license to reproduce, prepare derivative works, distribute copies to the public, and to perform publicly and display publicly the copyrighted work. This license extends to contractors and others doing work on behalf of the government.

N. Export Control

The U.S. government regulates the transfer of information, commodities, technology, and software considered to be strategically important to the U.S. to protect national security, foreign policy, and economic interests without

imposing undue regulatory burdens on legitimate international trade. There is a network of federal agencies and regulations that govern exports that are collectively referred to as "Export Controls". All recipients and subrecipients are responsible for ensuring compliance with all applicable U.S. Export Control laws and regulations relating to any work performed under a resulting award.

The recipient must immediately report to DOE any export control violations related to the project funded under the DOE award, at the recipient or subrecipient level, and provide the corrective action(s) to prevent future violations.

O. Prohibition on Certain Telecommunications and Video Surveillance Services and Equipment

As set forth in 2 CFR 200.116, recipients and subrecipients are prohibited from obligating or expending project funds (federal funds and recipient cost share) to:

(1) Procure or obtain;

(2) Extend or renew a contract to procure or obtain; or

(3) Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115-232, Section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

(i) For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).

(ii) Telecommunications or video surveillance services provided by such entities or using such equipment.

(iii) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country

See Public Law 115-232, Section 889 for additional information.

P. Personally Identifiable Information (PII)

All information provided by the applicant must to the greatest extent possible exclude PII. The term "PII" refers to information which can be used to distinguish or trace an individual's identity, such as their name, social security number, biometric records, alone, or when combined with other personal or identifying information which is linked or linkable to a specific individual, such as date and place of birth, mother's maiden name. (See OMB Memorandum M-07-16 dated May 22, 2007, found at: https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2007/m07-16.pdf

By way of example, applicants must screen resumes to ensure that they do not contain PII such as personal addresses, personal landline/cell phone numbers, and personal emails. **Under no circumstances should Social Security Numbers (SSNs) be included in the application**. Federal agencies are prohibited from the collecting, using, and displaying unnecessary SSNs. (See, the Federal Information Security Modernization Act of 2014 (Pub. L. No. 113-283, Dec 18, 2014; 44 U.S.C. § 3551).

Q. Annual Independent Audits

If a for-profit entity is a prime recipient and has expended $750,000 or more of DOE awards during the entity's fiscal year, an annual compliance audit performed by an independent auditor is required. For additional information, please refer to 2 CFR 910.501 and Subpart F.

If an educational institution, non-profit organization, or state/local government is a prime recipient or subrecipient and has expended $750,000 or more of federal awards during the non-federal entity's fiscal year, then a Single or Program-Specific Audit is required. For additional information, please refer to 2 CFR 200.501 and Subpart F.

Applicants and subrecipients (if applicable) should propose sufficient costs in the project budget to cover the costs associated with the audit. EERE will share in the cost of the audit at its applicable cost share ratio.

R. Informational Webinar

EERE will conduct one informational webinar during the FOA process. It will be held after the initial FOA release but before the due date for Concept Papers.

Attendance is not mandatory and will not positively or negatively impact the overall review of any applicant submissions. As the webinar will be open to all applicants who wish to participate, applicants should refrain from asking questions or communicating information that would reveal confidential and/or proprietary information specific to their project. Specific dates for the webinar can be found on the cover page of the FOA.

APPENDIX A – COST SHARE INFORMATION

Cost Sharing or Cost Matching

The terms "cost sharing" and "cost matching" are often used synonymously. Even the DOE Financial Assistance Regulations, 2 CFR 200.306, use both of the terms in the titles specific to regulations applicable to cost sharing. EERE almost always uses the term "cost sharing," as it conveys the concept that non-federal share is calculated as a percentage of the Total Project Cost. An exception is the State Energy Program Regulation, 10 CFR 420.12, State Matching Contribution. Here "cost matching" for the non-federal share is calculated as a percentage of the federal funds only, rather than the Total Project Cost.

How Cost Sharing Is Calculated

As stated above, cost sharing is calculated as a percentage of the Total Project Cost. FFRDC costs must be included in Total Project Costs. The following is an example of how to calculate cost sharing amounts for a project with $1,000,000 in federal funds with a minimum 20% non-federal cost sharing requirement:

- Formula: Federal share ($) divided by federal share (%) = Total Project Cost
  Example: $1,000,000 divided by 80% = $1,250,000

- Formula: Total Project Cost ($) minus federal share ($) = Non-federal share ($)
  Example: $1,250,000 minus $1,000,000 = $250,000

- Formula: Non-federal share ($) divided by Total Project Cost ($) = Non-federal share (%)
  Example: $250,000 divided by $1,250,000 = 20%

What Qualifies For Cost Sharing

While it is not possible to explain what specifically qualifies for cost sharing in one or even a couple of sentences, in general, if a cost is allowable under the cost principles applicable to the organization incurring the cost and is eligible for reimbursement under an EERE grant or cooperative agreement, then it is allowable as cost share. Conversely, if the cost is not allowable under the cost principles and not eligible for reimbursement, then it is not allowable as cost share. In addition, costs may not be counted as cost share if they are paid by the federal government under another award unless authorized by federal statute to be used for cost sharing.

The rules associated with what is allowable as cost share are specific to the type of organization that is receiving funds under the grant or cooperative agreement, though are generally the same for all types of entities. The specific rules applicable to:

- FAR Part 31 for For-Profit entities, (48 CFR Part 31); and
- 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

In addition to the regulations referenced above, other factors may also come into play such as timing of donations and length of the project period. For example, the value of ten years of donated maintenance on a project that has a project period of five years would not be fully allowable as cost share. Only the value for the five years of donated maintenance that corresponds to the project period is allowable and may be counted as cost share.

Additionally, EERE generally does not allow pre-award costs for either cost share or reimbursement when these costs precede the signing of the appropriation bill that funds the award. In the case of a competitive award, EERE generally does not allow pre-award costs prior to the signing of the Selection Statement by the EERE Selection Official.

General Cost Sharing Rules on a DOE Award

1. Cash Cost Share – encompasses all contributions to the project made by the recipient or subrecipient(s), for costs incurred and paid for during the project. This includes when an organization pays for personnel, supplies, equipment for their own company with organizational resources. If the item or service is reimbursed for, it is cash cost share. All cost share items must be necessary to the performance of the project.

2. In-Kind Cost Share – encompasses all contributions to the project made by the recipient or subrecipient(s) that do not involve a payment or reimbursement and represent donated items or services. In-Kind cost share items include donated existing equipment, donated existing supplies. The cash value and calculations thereof for all In-Kind cost share items must be justified and explained in the Cost Share section of the project Budget Justification. All cost share items must be necessary to the performance of the project. If questions exist, consult your DOE contact before filling out the In-Kind cost share section of the Budget Justification.

3. Funds from other federal sources MAY NOT be counted as cost share. This prohibition includes FFRDC subrecipients. Non-federal sources include any source not originally derived from federal funds. Cost sharing commitment letters from subrecipients must be provided with the original application.

4. Fee or profit, including foregone fee or profit, are not allowable as project costs (including cost share) under any resulting award. The project may only incur those costs

that are allowable and allocable to the project (including cost share) as determined in accordance with the applicable cost principles prescribed in FAR Part 31 for For-Profit entities and 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

DOE Financial Assistance Rules 2 CFR Part 200 as amended by 2 CFR Part 910

As stated above, the rules associated with what is allowable cost share are generally the same for all types of organizations. Following are the rules found to be common, but again, the specifics are contained in the regulations and cost principles specific to the type of entity:

(A) Acceptable contributions. All contributions, including cash contributions and third party in-kind contributions, must be accepted as part of the prime recipient's cost sharing if such contributions meet all of the following criteria:

(1) They are verifiable from the recipient's records.

(2) They are not included as contributions for any other federally-assisted project or program.

(3) They are necessary and reasonable for the proper and efficient accomplishment of project or program objectives.

(4) They are allowable under the cost principles applicable to the type of entity incurring the cost as follows:

a. For-profit organizations. Allowability of costs incurred by for-profit organizations and those nonprofit organizations listed in Attachment C to OMB Circular A–122 is determined in accordance with the for-profit cost principles in 48 CFR Part 31 in the FAR, except that patent prosecution costs are not allowable unless specifically authorized in the award document. (v) Commercial Organizations. FAR Subpart 31.2—Contracts with Commercial Organizations; and

b. Other types of organizations. For all other non-federal entities, allowability of costs is determined in accordance with 2 CFR Part 200 Subpart E.

(5) They are not paid by the federal government under another award unless authorized by federal statute to be used for cost sharing or matching.

(6) They are provided for in the approved budget.

(B) Valuing and documenting contributions

(1) Valuing recipient's property or services of recipient's employees. Values are established in accordance with the applicable cost principles, which mean that amounts chargeable to the project are determined on the basis of costs incurred. For real property or equipment used on the project, the cost principles authorize depreciation or use charges. The full value of the item may be applied when the item will be consumed in the performance of the award or fully depreciated by the end of the award. In cases where the full value of a donated capital asset is to be applied as cost sharing or matching, that full value must be the lesser or the following:

a. The certified value of the remaining life of the property recorded in the recipient's accounting records at the time of donation; or

b. The current fair market value. If there is sufficient justification, the Contracting Officer may approve the use of the current fair market value of the donated property, even if it exceeds the certified value at the time of donation to the project. The Contracting Officer may accept the use of any reasonable basis for determining the fair market value of the property.

(2) Valuing services of others' employees. If an employer other than the recipient furnishes the services of an employee, those services are valued at the employee's regular rate of pay, provided these services are for the same skill level for which the employee is normally paid.

(3) Valuing volunteer services. Volunteer services furnished by professional and technical personnel, consultants, and other skilled and unskilled labor may be counted as cost sharing or matching if the service is an integral and necessary part of an approved project or program. Rates for volunteer services must be consistent with those paid for similar work in the recipient's organization. In those markets in which the required skills are not found in the recipient organization, rates must be consistent with those paid for similar work in the labor market in which the recipient competes for the kind of services involved. In either case, paid fringe benefits that are reasonable, allowable, and allocable may be included in the valuation.

(4) Valuing property donated by third parties.

a. Donated supplies may include such items as office supplies or laboratory supplies. Value assessed to donated supplies included in the cost sharing or matching share must be reasonable and must not exceed the fair market value of the property at the time of the donation.

b. Normally only depreciation or use charges for equipment and buildings may be applied. However, the fair rental charges for land and the full value of equipment or other capital assets may be allowed, when they will be consumed in the

performance of the award or fully depreciated by the end of the award, provided that the Contracting Officer has approved the charges. When use charges are applied, values must be determined in accordance with the usual accounting policies of the recipient, with the following qualifications:

i. The value of donated space must not exceed the fair rental value of comparable space as established by an independent appraisal of comparable space and facilities in a privately-owned building in the same locality.

ii. The value of loaned equipment must not exceed its fair rental value.

(5) Documentation. The following requirements pertain to the recipient's supporting records for in-kind contributions from third parties:

a. Volunteer services must be documented and, to the extent feasible, supported by the same methods used by the recipient for its own employees.

b. The basis for determining the valuation for personal services and property must be documented.

APPENDIX B – SAMPLE COST SHARE CALCULATION FOR BLENDED COST SHARE PERCENTAGE

The following example shows the math for calculating required cost share for a project with $2,000,000 in federal funds with four tasks requiring different non-federal cost share percentages:

Task	Proposed Federal Share	Federal Share %	Recipient Share %
Task 1 (R&D)	$1,000,000	80%	20%
Task 2 (R&D)	$500,000	80%	20%
Task 3 (Demonstration)	$400,000	50%	50%
Task 4 (Outreach)	$100,000	100%	0%

Federal share ($) divided by federal share (%) = Task Cost

Each task must be calculated individually as follows:

Task 1
$1,000,000 divided by 80% = $1,250,000 (Task 1 Cost)
Task 1 Cost minus federal share = non-federal share
$1,250,000 - $1,000,000 = $250,000 (non-federal share)

Task 2
$500,000 divided 80% = $625,000 (Task 2 Cost)
Task 2 Cost minus federal share = non-federal share
$625,000 - $500,000 = $125,000 (non-federal share)

Task 3
$400,000 / 50% = $800,000 (Task 3 Cost)
Task 3 Cost minus federal share = non-federal share
$800,000 - $400,000 = $400,000 (non-federal share)

Task 4
Federal share = $100,000
Non-federal cost share is not mandated for outreach = $0 (non-federal share)

The calculation may then be completed as follows:

Tasks	$ Federal Share	% Federal Share	$ Non-Federal Share	% Non-Federal Share	Total Project Cost
Task 1	$1,000,000	80%	$250,000	20%	$1,250,000
Task 2	$500,000	80%	$125,000	20%	$625,000
Task 3	$400,000	50%	$400,000	50%	$800,000
Task 4	$100,000	100%	$0	0%	$100,000
Totals	$2,000,000		$775,000		$2,775,000

Blended Cost Share %
Non-federal share ($775,000) divided by Total Project Cost ($2,775,000) = 27.9% (non-federal)
Federal share ($2,000,000) divided by Total Project Cost ($2,775,000) = 72.1% (federal)

APPENDIX C – WAIVER REQUESTS FOR: 1. FOREIGN ENTITY PARTICIPATION; AND 2. FOREIGN WORK

1. Waiver for Foreign Entity Participation

For projects selected under this FOA, all recipients and subrecipients must be organized, chartered or incorporated (or otherwise formed) under the laws of a state or territory of the United States; have majority domestic ownership and control; and have a physical location for business operations in the United States. To request a waiver of this requirement, an applicant must submit an explicit waiver request in the Full Application.

Waiver Criteria

Foreign entities seeking to participate in a project funded under this FOA must demonstrate to the satisfaction of DOE that:

a. Its participation is in the best interest of the U.S. industry and U.S. economic development;
b. The project team has appropriate measures in place to control sensitive information and protect against unauthorized transfer of scientific and technical information;
c. Adequate protocols exist between the U.S. subsidiary and its foreign parent organization to comply with export control laws and any obligations to protect proprietary information from the foreign parent organization;
d. The work is conducted within the U.S. and the entity acknowledges and demonstrates that it has the intent and ability to comply with the U.S. Manufacturing Plan; and
e. The foreign entity will satisfy other conditions that may be deemed necessary by DOE to protect U.S. government interests.

Content for Waiver Request

A Foreign Entity waiver request must include the following:

a. Information about the entity: name, point of contact, and proposed type of involvement in the project;
b. Country of incorporation, the extent of the ownership/level control by foreign entities, whether the entity is state owned or controlled, a summary of the ownership breakdown of the foreign entity and the percentage of ownership/control by foreign entities, foreign shareholders, foreign state or foreign individuals;

c. The rationale for proposing a foreign entity participate (must address criteria above);
d. A description of the project's anticipated contributions to the U.S. economy;
    - How the project will benefit U.S. research, development and manufacturing, including contributions to employment in the U.S. and growth in new markets and jobs in the U.S.;
    - How the project will promote domestic American manufacturing of products and/or services;
e. A description of how the foreign entity's participation is essential to the project;
f. A description of the likelihood of Intellectual Property (IP) being created from the work and the treatment of any such IP; and
g. Countries where the work will be performed (Note: if any work is proposed to be conducted outside the U.S., the applicant must also complete a separate request foreign work waiver).

DOE may also require:

- A risk assessment with respect to IP and data protection protocols that includes the export control risk based on the data protection protocols, the technology being developed and the foreign entity and country. These submissions could be prepared by the project lead, but the prime recipient must make a representation to DOE as to whether it believes the data protection protocols are adequate and make a representation of the risk assessment – high, medium or low risk of data leakage to a foreign entity.
- Additional language be added to any agreement or subagreement to protect IP, mitigate risk or other related purposes.

DOE may require additional information before considering the waiver request.

The applicant does not have the right to appeal DOE's decision concerning a waiver request.

2. Waiver for Performance of Work in the United States (Foreign Work Waiver)

As set forth in Section IV.J.iii., all work under EERE funding agreements must be performed in the United States. There may be limited circumstances where it is in the interest of the project to perform a portion of the work outside the United States. To seek a waiver of the Performance of Work in the United States requirement, the applicant must submit an explicit waiver request in the Full Application. A separate waiver request must be submitted for each entity proposing performance of work outside of the United States.

Overall, a waiver request must demonstrate to the satisfaction of EERE that it would further the purposes of this FOA and is otherwise in the economic interests of the United States to perform work outside of the United States. A request to waive the Performance of Work in the United States requirement must include the following:

- The rationale for performing the work outside the U.S. ("foreign work");
- A description of the work proposed to be performed outside the U.S.;
- An explanation as to how the foreign work is essential to the project;
- A description of the anticipated benefits to be realized by the proposed foreign work and the anticipated contributions to the U.S. economy;
- The associated benefits to be realized and the contribution to the project from the foreign work;
- How the foreign work will benefit U.S. research, development and manufacturing, including contributions to employment in the U.S. and growth in new markets and jobs in the U.S.;
- How the foreign work will promote domestic American manufacturing of products and/or services;
- A description of the likelihood of Intellectual Property (IP) being created from the foreign work and the treatment of any such IP;
- The total estimated cost (DOE and recipient cost share) of the proposed foreign work;
- The measures in place to control sensitive information and protect against unauthorized transfer of scientific and technical information;
- The countries in which the foreign work is proposed to be performed; and
- The name of the entity that would perform the foreign work.

EERE may require additional information before considering the waiver request.

The applicant does not have the right to appeal EERE's decision concerning a waiver request.

APPENDIX D – REQUIRED USE OF AMERICAN IRON, STEEL, MANUFACTURED PRODUCTS, AND CONSTRUCTION MATERIALS BUILD AMERICA BUY AMERICA REQUIREMENTS FOR INFRASTRUCTURE PROJECTS

A. Definitions

For purposes of the Buy America requirements, the following definitions apply:

Construction materials includes an article, material, or supply—other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives[88] —that is or consists primarily of:

- non-ferrous metals;
- plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables);
- glass (including optic glass);
- lumber; or
- drywall.

Infrastructure includes, at a minimum, the structures, facilities, and equipment for, in the United States, roads, highways, and bridges; public transportation; dams, ports, harbors, and other maritime facilities; intercity passenger and freight railroads; freight and intermodal facilities; airports; water systems, including drinking water and wastewater systems; electrical transmission facilities and systems; utilities; broadband infrastructure; and buildings and real property. Infrastructure includes facilities that generate, transport, and distribute energy.

In addition to the above, the infrastructure in question must be publicly-owned or must serve a public function; privately owned infrastructure that is solely utilized for private use is not considered "infrastructure" for purposes of Buy America applicability. The Agency, not the applicant, will have the final say as to whether a given project includes infrastructure, as defined herein. Accordingly, in cases where the "public" nature of the infrastructure is unclear, DOE strongly recommends that applicants complete their full application with the assumption that Buy America requirements will apply to the proposed project.

Project means the construction, alteration, maintenance, or repair of infrastructure in the United States.

B. Buy America Requirements for Infrastructure Projects ("Buy America" requirements)

[88] BIL, § 70917(c)(1).

In accordance with section 70914 of the BIL, none of the project funds (includes federal share and recipient cost share) may be used for a project for infrastructure unless:

> (1) all iron and steel used in the project are produced in the United States--this means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States;
>
> (2) all manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation; and
>
> (3) all construction materials[89] are manufactured in the United States—this means that all manufacturing processes for the construction material occurred in the United States. The Buy America requirements only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America requirements apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project, but are not an integral part of the structure or permanently affixed to the infrastructure project.

The Buy America requirements only apply to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does the Buy America requirements apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project, but are not an integral part of the structure or permanently affixed to the infrastructure project.

These requirements must flow down to all sub-awards, all contracts, subcontracts and purchase orders for work performed under the proposed project.

For additional information, please see OMB Memorandum M-22-11, issued April 18, 2022: https://www.whitehouse.gov/wp-content/uploads/2022/04/M-22-11.pdf Initial

[89] Excludes cement and cementitious materials, aggregates such as stone, sand, or gravel, or aggregate binding agents or additives.

Implementation Guidance on Application of Buy America Preference in Federal Financial Assistance Programs for Infrastructure

C. DOE Submission Requirements for Full Application

Within the first two pages of the workplan, applicants must provide a short statement on whether the project will involve the construction, alteration, and/or repair of infrastructure in the United States. The ultimate determination about whether a project includes infrastructure remains with DOE, but the applicant's statement will assist project planning and integration of domestic preference requirements, which may impact the project's proposed budget.

D. Waivers

In limited circumstances, DOE may waive the application of the Buy America requirements where DOE determines that:

> (1) applying the Buy America requirements would be inconsistent with the public interest;
>
> (2) the types of iron, steel, manufactured products, or construction materials are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality; or
>
> (3) the inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent.

If an applicant is seeking a waiver of the Buy America requirements, it must include a written waiver request with the Full Application. A waiver request must include:

- A detailed justification for the use of "non-domestic" iron, steel, manufactured products, or construction materials to include an explanation as to how the non-domestic item(s) is essential to the project
- A certification that the applicant or recipient made a good faith effort to solicit bids for domestic products supported by terms included in requests for proposals, contracts, and nonproprietary communications with potential suppliers;
- Applicant /Recipient name and Unique Entity Identifier (UEI)
- Total estimated project cost, DOE and cost-share amounts
- Project description and location (to the extent known)
- List and description of iron or steel item(s), manufactured goods, and construction material(s) the applicant or recipient seeks to waive from Domestic Content Procurement Preference requirement, including name, cost, country(ies) of origin (if known), and relevant PSC and NAICS code for each.

- Waiver justification including due diligence performed (e.g., market research, industry outreach) by the applicant or recipient
- Anticipated impact if no waiver is issued

DOE may require additional information before considering the waiver request.

Waiver requests are subject to public comment periods of no less than 15 days and must be reviewed by the Made in America Office. There may be instances where an award qualifies, in whole or in part, for an existing waiver described at https://www.energy.gov/management/financial-assistance.

The applicant does not have the right to appeal DOE's decision concerning a waiver request.

APPENDIX E – DEFINITION OF TECHNOLOGY READINESS LEVELS

TRL 1:	Basic principles observed and reported
TRL 2:	Technology concept and/or application formulated
TRL 3:	Analytical and experimental critical function and/or characteristic proof of concept
TRL 4:	Component and/or breadboard validation in a laboratory environment
TRL 5:	Component and/or breadboard validation in a relevant environment
TRL 6:	System/subsystem model or prototype demonstration in a relevant environment
TRL 7:	System prototype demonstration in an operational environment
TRL 8:	Actual system completed and qualified through test and demonstrated
TRL 9:	Actual system proven through successful mission operations

APPENDIX F – LIST OF ACRONYMS

ACE	Area Control Error
AGC	Automatic Generator Control
BIL	Bipartisan Infrastructure Law
CAISO	California Independent System Operator
COI	Conflict of Interest
CNN	Convolutional Neural Network
CSP	Concentrating Solar-Thermal Power
DEC	Determination of Exceptional Circumstances
DEI	Diversity, Equity, and Inclusion
DER	Distributed Energy Resource
DMP	Data Management Plan
DMS	Demand-Side Management
DOE	Department of Energy
DOI	Digital Object Identifier
EERE	Energy Efficiency and Renewable Energy
EMT	Electromagnetic Transient
EQ	Environmental Questionnaire
ERCOT	Electric Reliability Council of Texas
FAR	Federal Acquisition Regulation
FDR	Fault Data Recorder
FERC	Federal Energy Regulatory Commission
FFATA	Federal Funding and Transparency Act of 2006
FOA	Funding Opportunity Announcement
FOIA	Freedom of Information Act
FFRDC	Federally Funded Research and Development Center
FY	Fiscal Year
GAAP	Generally Accepted Accounting Principles
GMLC	Grid Modernization Laboratory Consortium
GW_{ac}	Gigawatt
HBCU	Historically Black Colleges and Universities
HIL	Hardware-in-the-Loop
IBR	Inverter-Based Resource
IIJA	Infrastructure Investment and Jobs Act
IPMP	Intellectual Property Management Plan
ISO	Independent System Operator
kV	Kilovolt
M&O	Management and Operating
MPIN	Marketing Partner ID Number
MSI	Minority-Serving institution
MYPP	Multi-Year Program Plan
MW	Megawatt

NDA	Non-Disclosure Acknowledgement
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
NNSA	National Nuclear Security Agency
OMB	Office of Management and Budget
OSTI	Office of Scientific and Technical Information
PII	Personal Identifiable Information
PMU	Phasor Measurement Unit
PV	Photovoltaic
RDD&D	Research, Development, Demonstration, and Deployment
R&D	Research and Development
RFI	Request for Information
RFP	Request for Proposal
ROCOF	Rate of Change of Frequency
RTO	Regional Transmission Organization
SAM	System for Award Management
SETO	Solar Energy Technologies Office
SOPO	Statement of Project Objectives
SPOC	Single Point of Contact
STEM	Science, Technology, Engineering, and Mathematics
TIA	Technology Investment Agreement
TRL	Technology Readiness Level
TW_{ac}	Terawatt
UCC	Uniform Commercial Code
UEI	Unique Entity Identifier
WBS	Work Breakdown Structure
WETO	Wind Energy Technologies Office
WP	Work Proposal